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☞ An asterisk (*) denotes an illustrated article

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WISHING TO MAKE THIS JOURNAL an organ of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, the publishers solicit Correspondence for publication from all among them who make the study of these subjects a pleasure, or a profession.

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STANDARD BURNERS.

In another column will be found a letter from a correspondent on the Pacific Coast making some inquiries about burners used in testing gas, which are very pertinent, and will be read no doubt with interest. We shall be disappointed if there are not several replies to this letter, for it is one which touches a very important point.

In reply to J. T. B.'s first question, we can only say that the reason why the New York examiner uses a 15-hole Argand is probably because the contract with the city requires gas to be of a certain illuminating power when tested in that way. As to the second question: Every reader of the GAS-LIGHT JOURNAL should know that better results have been obtained with several of Sugg's improved burners than can be obtained from the old standard burner. The main reason for retaining the old standard burner is a good and valid one, viz:

Since its adoption as a standard, all records of illuminating power are supposed to be referred to that standard. If a man can make a burner that increases his illuminating power two, three, or more candles, it is most praiseworthy, for it enables the consumer to get more light for the same money; but when this man states the illuminating power of his gas, it is naturally supposed to be expressed in terms of the *standard* measure, if nothing is said to the contrary.

To prevent any misunderstanding, or a charge of misrepresentation, every one should be extremely careful, in stating his illuminating power, to give the kind of burner it is tested by, if any other is used than the generally accepted standard.

The reason for doing this is too evident te require any explanation. If a manager wants to compare present with past results, he must have a common standard of comparison for his illuminating power, that his "candle feet" in one case may be on the same basis as in the other. If two managers wish to compare results, the same thing must happen—they must get on to the same basis with the same standard of comparison. If both use the old 15-hole Argand, they both know what they are talking about. If they use something else they may both know what they are using as a standard (so called) or they may not.

Our correspondent expresses a hope that he may hear from some who are using the new Argand burners. We trust he will; and that, at the same time, that the old standard will not be without advocates.

GAS WORKS FOR THE NEW JERSEY CENTRAL RAILROAD.

The New Jersey Central Railroad Company have recently completed a small gas works for the purpose of supplying their passenger and freight depots, their ferry houses and ferry boats, with gas for illuminating purposes. Heretofore, owing to their isolated position, the company has been forced to use kerosene oil for lighting purposes.

The cost, the waste, but, above all, the great danger to a large amount of property which the extended use of kerosene lamps involved induced the Receiver of the railroad, under whose management the road is now operated, to erect the small works now referred to. The result thus far has been an increase of light, at a reduced cost. The daily consumption is about 5000 cubic feet. The works consist of two benches of three small iron retorts, a condenser, washer, and holder; the latter being placed in a wooden tank above the ground. The gas is made principally from the cotton waste collected along the line of the road; this is mixed with some sawdust, and sometimes a small portion of petroleum is added. The materials are placed in a sheet iron cylinder, open at both ends, and perforated on the sides. These cylinders are a little smaller than the retorts, and being filled, are put in like a cartridge. In case the supply of waste should run short, a portion of the retorts are arranged to introduce petroleum into the back end.

The gas made is, of course, an oil gas; but it seems to answer the purpose for which it was intended, and furnishes a great security against the danger from fire incident to the use of kerosene. We have some doubt as to whether more satisfactory results, in some respects, would not have been obtained if a regular coal gas works, of the same capacity, had been put up; but, nevertheless the principle adopted, of lighting the buildings and boats with gas, is a correct one, and if experience proves that oil is not satisfactory, it will be easy to change the works to coal.

Quite an amount of charcoal is obtained as a residual product, which is available for useful purposes.

Anthracite screenings, which come from the engine houses, and cost the company practically nothing except the expense of collecting and carting, is the fuel used under the benches. The principal skill required in the manipulation of the process is only that necessary to keep the heats right.

THE PHYSICS OF COAL GAS.

We would call the attention of our readers to an article under this title, from the pen of Robert Briggs, Esq., C. E., in another column. It is an extremely valuable contribution to the gas literature of the day, and will be found one of the most thorough and exhaustive discussions of the subject that has yet appeared. We commend it to the careful attention of our readers.

THE AITKEN AND YOUNG PROCESS.

In another column will be found a portion of a Report, to the West of Scotland Association, on the above-named process. We received a letter from Mr. Young, shortly after the meeting, stating that he would forward us a corrected copy of the report and discussion, and, consequently, we have delayed the report till now, when we give it to our rerders as received from Mr. Young. Our space does not admit of giving the whole in this issue, but we hope to give the remainder in the next.

WATER, GAS AND STEAM is the title of a new monthly, issued as a scientific and trade journal for plumbers, and pipe fitters, metal founders, machinists, etc., etc. It will contain information useful to manufacturers, hydraulic engineers, gas and water company officials, architects and builders, etc., etc. It is printed on good paper, in handsome type, and is offered at the low price of $2 per annum. Published in Philadelphia.

Paraffines in Water-Gas, and Carbonic Oxide as a Poison.

ADDENDA AND ERRATA by HENRY MORTON, Ph.D.

Since the appearance of my last article in this JOURNAL, I have completed an analysis of the Harrisburgh water-gas, recently collected, in which the "paraffines" were determined by absorption with alcohol, the residual alcohol vapor being afterwards removed by Nordhausen acid.

The results obtained were as follows:

Carbonic acid	3·402
Oxygen	Trace
Olefines	12·828
Carbonic oxide	25·233
Hydrogen	34·548
Marsh gas	21·699
Nitrogen	1·408
Paraffines	·869
	99·987

The difference between this and the analysis given in the last issue (assuming that the gas in each case was about the same in composition) agrees entirely with my conclusion, made long ago, that the amount of "paraffines" present was insignificant, and that, for practical purposes, it might be neglected, where the question at issue was the commercial value of such a gas and not its theoretical relations.

These results are also interesting in connection with another point. Of course it is well known that if water is decomposed by carbon the volume of hydrogen liberated must equal that of the carbonic oxide formed, plus twice that of the carbonic acid produced. This is very well stated by Mr. Edgerton, in his recent article, where, as will be easily perceived, his conclusions entirely agree with those of Mr. Geyer and myself, and support my early analysis of the Harrisburgh gas in which the "paraffines" were neglected.

The relations between the hydrogen, carbonic oxide and carbonic acid found, with the paraffines removed, agrees as closely as could be expected with the theoretical considerations indicated; and the analysis in which they were disregarded likewise agrees with the same theoretical considerations, when this small amount (about ·8 of a per cent.) of paraffines, of an average composition similar to that of propane, is allowed for.

There is, however, another much more important consideration to be regarded in this connection.

If the free hydrogen took up, as has been claimed, in the "fixing" part of the apparatus, any carbon or combined with any of the hydrocarbons there present, this relation of the various constituents would hardly remain as we find it.

This, therefore, is indirectly an argument of no small weight on that question, so important in some respects, and yet so difficult to test directly.

As so often happens as soon as my papers on carbonic oxide were published, I noticed several errors which had escaped me in reading the proofs.

Thus, on page 91, third column, the quotation from Hasselt ceases with the word "man." The remaining words are an abstract of a lengthy statement, not a literal quotation of the author's words.

On page 113, third column, close to top of page, the quotation from Hermann is out of its place, and should have been immediately before the heading ETHANE in the previous column. The formula for "ethylene gas," or olefiant gas as we more commonly call it, should of course be C_2H_4, and not C_2H_6.

On page 114, first column, a little below the middle, several words are omitted. The paragraph should read: Thus, olefiant gas yields twice as much carbonic acid as marsh gas, and other members of the olefine series, progressively, three, four, and five times as much. Acetylene *yields twice as much as marsh gas, and* benzole six times as much, etc. I have italicized the omitted words.

I intended in this place to have acknowledged the correctness of Mr. Brigg's correction of my 70 per cent. of carbonic acid, which, as I have mentioned, was an error of inadvertence, and wish now to thank him for pointing it out.

On page 114, middle column, fifth paragraph. 300 should be 200, and 40 should be 37.

On the Hayford Process and Apparatus for Preserving Timber.

By EDWARD R. ANDREWS, of Boston.

[Concluded from page 115.]

But with a creosoted tie the spike will not corrode and will not work loose; the surface of the tie under the rail will not decay or wear, because not affected by alternate dryness and moisture; there will be no play of the rail upon the tie, and consequently no friction and no cutting. No, there is every reason for believing that creosoted ties will last here 20 years as well as in England, and their general use would be equal to a saving of three per cent. per annum, on the cost of the railways of this country.

I have referred principally to the uses of creosoted wood on railways, because they are the great consumers of lumber, but it should commend itself equally to architects, builders, and carpenters.

CREOSOTE AS A PROTECTION AGAINST THE TEREDO, ETC.

I have referred thus far to creosoting as a protection against decay only, but it is equally a specific against destruction of wood by marine worms. This quality of dead oils is almost as important as their efficacy against decay. Bear in mind that from Maine to Texas there is scarcely a point on our coast, where our piers and wharves are not rapidly destroyed by the Teredo Navalis, or the Lymnoria Terebrans.

On the table before me are specimens of wood destroyed by these ravagers at different points, in a few months or years, at Boston, Provincetown, New York, and the Gulf of Mexico.

So far as I am aware, the teredo is not found north of Cape Cod, but the lymnoria is scarcely less destructive.

In many places in the Gulf, the teredo will destroy large piles in a single year. They are found sometimes two feet long.

The teredo infests the coasts of Great Britain, Holland, Belgium and France, and is quite as destructive there as here; were it not for the use of creosoted piling, the piers of their harbors would require to be rebuilt every three or four years. There is not an instance on record where a pile, impregnated with creosote, to the extent of 10 or 12 pounds to the cubic foot, has been approached by the teredo or the lymnoria. Piers built in 1850 are perfectly sound to-day.

Places where creosoted wood has been used as a protection against the teredo in Great Britain.	Dates. When exposed.	Dates. When last examined.	Duration. Years.
Port of Sunderland....	1839	1859	20
" Teignmouth..	1842	1849	7
" Lowestoft.....	1846	1859	13
" Leith.....	1848 1854	1862	14 8
" Southampton..	1848	1852	4
" Brighton.....	1848	1851	3
" Manchester....	1850	1861	11
" Portland.....	1853	1861	8
" Holyhead.....	1854	1861	7

The importance of protecting these harbor works has been considered so serious a matter, that most careful experiments have been tried, extending through a series of years, under commissioners appointed by the different governments, whose official reports are accessible to all. Every other suggested remedy was tried and failed in every instance. The terrible mollusk or crustacean seemed to fatten upon every poison, and would manage to work its way between copper or iron headed nails or copper plates, but he turned his back invariably upon creosote.* All the official reports agree upon this point, that creosote, and that alone, thoroughly injected into wood, will protect it completely.

There is, however, one other remedy, and that is sewerage. It is fortunate that sewerage serves one good purpose. These enemies require clear, salt water, free from any brackishness. It carefully avoids a pier in New York, where a sewer empties, but it luxuriates in the next, which is free from that nuisance.

The importance of creosoting ship timber should not be overlooked. I have specimens of birch before me taken from the side of a vessel, which had been six months at Key West, completely riddled by the teredo. How often may it be that vessels, lost at sea and never heard from, have sprung a leak through some teredo eaten timbers. Remember, too, that dry rot

* See papers by E. H. Baumhauer, on "The Teredo, and the means of preserving wood from its ravages;" Archives of Holland, Vol. I., 1864. Auguste Forestier, Engineer of Roads and Bridges; Annales Françaises, 1864. M. Crepin, Engineer of Roads and Bridges of Belgium; Report of experiments at Liege, from 1857 to 1867.

would be prevented also, and, perhaps, all necessity for copper bottoms. It would seem that creosote is as useful at sea as on land. Its use is everywhere a true economy.

Our own Government has the honor of being the first to creosote ship timbers. In 1872 creosoting works were erected at the navy yard in Charlestown, under the superintendence of Mr. Hayford, who took charge of the treatment of the timbers for the "Vandalia," the vessel which is now the home of General Grant in the Mediterranean.

The ribs of the "Vandalia" are of live oak, but all the rest of the planking and decks, inside and out, were creosoted by Mr. Hayford. This vessel was completed in 1873, and fitted for sea in 1875. Thus far no report has been made of her condition to the Department.

It is well to select, for creosoting, woods which are porous and will absorb oil readily. Cheap woods, which, unpreserved, rot quickly, can thus be made more solid and more enduring than the most expensive timber. I think the cotton wood of the Southwest can be made as useful as oak for ties. White pine absorbs creosote like a sponge, and the yellow pine of the South takes it readily also. In England, fir from the Baltic is used altogether for ties, and I do not see why the despised fir from our forests may not be used for the same purpose here. Hemlock is good also; it holds a spike well. Spruce is a firm compact wood, and absorbs oil with more difficulty, neither does it require so much to preserve it. Its sap-wood, where decay commences, is always saturated, and the heart, if treated green, shows more or less oil all through the annular rings. Oak has a course fibre, and is easily treated.

The limits of a single evening are insufficient, Mr. President and gentlemen, to do justice to so important an industry as this. I thank you for your kind attention, and need not say that I shall be glad, as far as I can to answer any questions which may lead to a clear and full understanding of a subject in which so many of you, I am sure, must feel a deep interest.

The speaker presented, in support of his views and statements, a large number of letters from engineers in this and other countries, referring to some important works where creosoted timber had been exposed for many years, with the most satisfactory results; among which are the Yorkshire and Lancashire Railway, England, Southern Railroad, France, the Leith Pier, Edinburgh Scotland.

Report on the Aitken and Young Process of Gas Making.

BY THE SUB-COMMITTEE OF THE WEST OF SCOTLAND ASSOCIATION OF GAS-MANAGERS,

APRIL 26TH, 1877.

At a meeting of the committee, held at Glasgow on the 7th day of August, 1876 a sub-committee was appointed, consisting of the following gentlemen:—Mr. Wm. Smith, Helensburgh; Mr. Jas. M'Gilchrist, Dumbarton; Mr. R. S. Carlow, Port-Glasgow; and Mr. L. Monk, Lanark (convener), to investigate into the practical working of the Aitken and Young patent condensing process at Hamilton gas works. It was also suggested that the sub-committee should endeavor to secure the practical and scientific assistance of their honorary member, Mr. Stewart, of Greenock. On application being made to that gentleman, he at once kindly agreed, if his spare time should admit, to give them all the assistance in his power.

A preliminary meeting of the sub-committee was held at Dumbarton on the 29th day of August, 1876, at which Mr. Stewart was also present, when it was considered expedient that, before entering upon the regular trials, it would be advisable to visit the Hamilton works, and make themselves thoroughly conversant with the whole arrangement, and also make such alterations and additions as would be necessary to have the trials made in the manner desired by them. In accordance with this resolution, the sub-committee, along with Mr. Stewart, visited the Hamilton works on the 5th day of September, 1876, and made a preliminary inspection of the whole arrangement, which consisted of the following plant:—The retorts are of fire-clay of the ordinary D-shape, 26 inches by 15 inches, by 7 feet 8 inches long, set three in an oven, the whole bench consisting of 27 retorts, 12 of which were in use at the date of the visit. The hydraulic main is D-shaped, 18 inches by 18 inches, placed on pillars alongside of the front wall. The stand-pipes are carried overhead to the hydraulic, and some of the stand-pipes (*i. e.*, from top of ascension-pipe to hydraulic) were covered with some non-conducting composition. The outlet from hydraulic main, 10 inches diameter, passes across the retort-house, 30 feet, and along the wall of purifying house, 40 feet, to condensers, which are of the ordinary vertical pipe description, the pipes 12 inches diameter, and placed at the back of the retort-house, as is also the new analyzing condensing arrangement. This arrangement is similar in construction to the model shown at our Glasgow and Greenock meetings, and which is here again for the inspection of those members who had not the opportunity of seeing it before. The pipes leading from the hydraulic, and into the condensers and scrubber, are connected by branch-pipes in such a manner that, by means of slide valves, either the analyzing condensing or the ordinary condensing apparatus may be thrown into use. At the desire of the sub-committee this was done to show the working, when they were much surprised with the difference in the character of the gases condensed by the two processes.

Then, when the ordinary process was thrown into action, the gases, as they issued from a ¾-inch stop-cock placed on the inlet to the scrubber, had a brown, smoky appearance, and when allowed to blow on a piece of paper, gave a black, tarry stain. On the other hand, when the analyzing condensing arrangement was thrown into action, the issuing gases were comparatively colorless, and gave only a slight brown stain to paper, which rapidly dried upon exposure to the air.

As already stated, the gases pass from either of the condensing arrangements to the ordinary square perforated plate scrubber, and when the analyzing condensing arrangement is in use, the mixed tars and weak liquors are run from the bottom of the analyzer into the cooling-tank, where they are cooled and separated, the weak liquor being pumped into the scrubber and the tars run off to the tar-well. From the scrubber the gases pass to the exhauster, which is of the kind known as "Anderson's," thence to four purifiers, lime being the sole purifying agent employed. The station-meter is very small for the quantity of gas it has to register, but the sub-committe considered that, as the tests were to be comparative, and the measure of the gas made with the same instrument, any error made would affect both processes alike. The gasholders are three in number the one nearest the testing-station having a capacity of 36,000 cubic feet. From the manner in which it was connected with the main leading to the town and inlet-main from works, it was selected by the sub-committee as the one best suited to be connected to the testing apparatus in the laboratory to be employed during the trials. At the request of the sub-committee, a ¾-inch pipe was carried from the inlet of the gasholder into the testing-room that experiments might be made with the gas just as it was newly made, and also after having been stored for some time; and, further, to test the gas after being passed through a long length of main underground, a testing-station was prepared about 2000 yards from the works. The testing apparatus at both stations were as far as possible duplicates of each other, and the same candles and burner were used at both stations.

The nature of the processes to be tested necessitated that the same gas-producing material should be used for a considerable time, and as the season was far advanced, and the consumption great, and also as the capacity of the works was not sufficient to make and store two qualities of gas, it was seen by the sub-committee to be impossible to use a coal giving any other than a gas somewhat near what the consumers had been receiving. They, therefore, decided just to employ the usual materials used in the works for the trials. There was a mixture of Camp parrot and Westwood shale.

After having made these preliminary arrangements, the sub-committee again met at Hamilton gas works, on the 20th of October, 1876; Mr. Monk having visited and remained over from the previous day to see that the same descriptions of coal and shale were used, and that the analyzer should contain only tars and naphthas resulting from such proportions of shale and coal as were to be used in the trials. After a careful testing, with 36 hours working of each process, the average results were obtained as shown in Table No. I.

The temperature of the tars in the hydraulic ranged during the experiments from 180° to 190° Fahr., and the temperature of the tars as they issued from the analyzer ranged from 220° to 230° Fahr.

The results obtained from testing the gas as it was newly manufactured, after it had stood for twelve hours in the gasholder, and after it had travelled to the distant testing-station, were substantially the same by both methods of manufacture (*i. e.*, for permanency of hydrocarbons), no material deterioration of the illuminating power having taken place in either gas.

As indicated by the above table, samples of the tars from either process showed, on being carefully distilled, that the analyzer tar contained about two per cent less naphtha than the ordinary tar. The ammoniacal liquor, as it flowed from the analyzer, had a specific gravity of only 1½° Twaddel, and had a very feeble smell of ammonia, but, after it was cooled and passed through the scrubber, it acquired a specific gravity of 6° Twaddel. The ammoniacal liquor, as it flowed from the ordinary condensers, had a specific gravity of 3° Twaddel; that from the scrubber 4° Twaddel. By the ordinary process, water was in part used in the scrubber.

An examination of the gases, as they entered the purifiers, showed that the gases from the analyzer process were almost perfectly denuded of suspended tarry matter—indeed, they were almost colorless—whereas the gases condensed by the ordinary method had a slight smoky appearance, and contained a considerable quantity of suspended tarry matter.

To be continued.

[From advance sheets of the "Journal of the Franklin Institute," for April, '78.]

Physics of Coal Gas.

By Robert Briggs, C. E.

———oo———

Common Coal Gas—its Composition, and Results of Combustion.—Some forty or more distinct gaseous chemical components are well known to have existence in the ordinary coal gas of the gas works, in four several groups: the first of which are gases which burn in air without or with slight emission of light; the second, gases which, when burned with the first for supply of heat, evolve carbon, which, becoming incandescent before burning itself, emits light: the third, incombustible gases; and the fourth, gases which are considered impurities. The first group is over four-fifths of the volume of coal gas, and is composed of only three substances or compounds, to wit: hydrogen, marsh gas and carbonic oxide; the second, which is only 7 to 9 per cent., comprises an almost endless list of hydro carbon compounds, which are diffused, as gases or vapors, into the gases of the other groups; for the purpose of this paper this group will be considered as if composed entirely of olefiant gas (possibly most of these hydrocarbons are of the olefine series of compounds); the third comprises the carbonic acid, aqueous vapor and air, and is always 3 to 6 per cent. of coal gas; while the fourth, the impurities—ammonia and sulphur compounds; obnoxious as they are in quality, in any tolerably well purified gas the percentage of them in volume is so small, that in a discussion of results of combustion they do not become an element.

With this explanation to qualify the following statements and calculations, it is proper to say that common coal gas, of 14 to 15 candles illuminating power, has the following constituents in volumes per hundred parts: Hydrogen, H, 44 to 48; marsh gas, CH_4, 34 to 38; olefiant gas, C_2H_4, and other hydrocarbons, etc., 6 to 9; carbonic oxide, CO, 5 to 7; carbonic acid, CO_2, 1 to 3; air, 4N+O, 1 to 3; aqueous vapor, H_2O (saturation at 40° to 60°), 1 to 2. The specific gravity of coal gas is about 0·426, which makes the volume of a pound of gas at 70° (barometer 29·9 in.) equal to 31·3 cubic feet (neglecting fractions, too small to be of consequence in this estimate)=0·0319 lb. per cubic foot. Taking an average of the constituents of coal gas by weight, they can be reduced to 21·8 parts of hydrogen, 51·3 parts of carbon, and 13·6 parts of carbonic oxide, which are combustible; leaving 13·3 parts of non-combustible substances. The figures of the reduction of volumes to weights are as follows:

	Constituents.	Vols. per ct.	Do. av'g	Spec. gravity.	H.	C.		Wt. per ct.	
H	Hydrogen,	44@48	45	0·0692= 3·114	3·114		) H	9·266	21·8
CH_4	Marsh gas	34@38	36	0·559 =20·124	5·031	15·093			
C_2H_4	Olefiant gas	6@ 9	8	0·981 = 7·848	1·121	6·727	) C	21·820	51·3
CO	Carbonic oxide	5@ 7	6	0·967 = 5.802				5·802	13·6
CO_2	Carbonic acid	1@ 3	2	1·524 = 3·048				3·048	7·2
4N+O	Air	1@ 3	2	1·000 = 2·000				2·000	4·6
H_2O	Vapor of water	1@ 2	1	0·622 = 0·622				0·622	1·5
			100·		42·553	9·266	21·820	42·558	100·

From these data, the heat given out by *complete* combustion can be calculated—hydrogen gas will evolve in its chemical change to vapor of water, (including the latent heat of the vapor) 62,000 units of heat, while carbon, in becoming carbonic acid, evolves 14,500 units, and carbonic oxide, in changing to the same form, evolves 4,330 units—with the following result:

Combustion of 100 Pounds of Coal Gas.

Combustion.	Oxygen required	Air required Air required to supply oxygen	Air required to effect complete combustion.	Units of heat per lb. of combustible	Units of heat total evolved	Product. H_2O	Product. CO_2
H	21·8	174·4	785	1570	62000	1351600	196·2	
C	51·3	136·8	616	1232	14500	743850		188·1
CO	13·6	7·8	35	70	4330	58890		21·4
CO_2	7·2	0·						7·2
4N+O	4·6	0·						
H_2O*	1·5	0·					1·5	
	100·	319·	1436	2872		2154350	198·	217·

Deduct latent heat of 196·2 lbs. of vapor of 70°@1065°, 208950

Total units of heat from 100 lbs. of coal gas (86·7 combustible + 13·3 of non-combustible).....1945400

* This ratio of vapor of water corresponds to the condition of vapor in saturated air at the temperature of 43° or 41 per cent. humidity at 70°—perhaps a little dry for summer tests.

Accepting these quantities for the products of combustion of 100 pounds of coal gas, the absolute temperature attained may be estimated. Three different hypotheses present themselves: the first supposes the absolute heat to be that derived from the capacity of the product to take up the entire heat generated. The second limits the expenditure of heat in producing intensity, to the air needed to supply oxygen; while the third supposes the ultimate maximum intensity to be that derived from the chemical combination of oxygen and carbon, and of oxygen and hydrogen. The last is probably the correct value for the *intensity* of the source of radiating heat from a gas-light. The following table gives the three computations in the order named:

	Pounds x Spncific heat	Sum of weight = multiplied by Specific heat.	Pounds—sum, etc.		Pounds—sum, etc.	
H_2O	198×0·478= 94·050	H_2O	198; 94·050	H_2O	198;	94·050
N	1117×0·245=273·665	N	1117; 273·665			
4N+O	1436×0·238=341·768					
CO_2	217×0·217= 47·089	CO_2	217; 47·089	CO_2	217;	47·089
Total	2968×0·255=756·572		1532; 414·808		415;	141·139

If now the total number of units of heat, which resulted from the burning of 100 pounds of coal gas be divided by the sum of the weights of products of combustion, multiplied by their specific heat, the increment of heat to the products will be given by the result; which, added to the original or normal heat of the gas and air (here taken at 70°), will give the absolute temperature of the products as they are assumed to exist in the three suppositions,

Supposed absolute temperature of flame of coal gas, where the products of combustion are taken to include the volume of air, which is the requisite for complete combustion:

$$=\frac{1945000}{756·572}+70°=2641°.$$

Supposed absolute temperature of flame of coal gas, where the products of combustion are taken to include the air needed to supply oxygen of chemical combination:

$$=\frac{1945000}{418·804}+70°=4760°.$$

Supposed absolute temperature of flame of coal gas, where only the oxygen of chemical combination is taken into the estimate:

$$=\frac{1945000}{141·139}+70°=13885°.$$

At the same time we are discussing the absolute temperatures of coal gas flames, it may prove interesting to examine, separately, those of the three gases which compose it, as follows:

	Weight, pounds.	Oxygen, pounds.	Product of com.	Weight, pounds.	Specific heat.	Units heat.	Intensity of flame.
Hydrogen, H	1	8	H_2O	9	×0·475=4·275)	52447	(12268°+70°=12338°
Carbon, C	1	2	2-3 CO_2	3	2-3 ×0·217=0·796)	14500	(18223°+70°=18293°
Carb. ox., CO	1		4-7 CO_2	1	4-7 ×0·217=0·341)	4329	(12694°+70°=12764°

The value for the heat effect of one pound of hydrogen is derived in the same way as was used in the estimate for coal gas, as follows:

Total heat effect of 1 lb. of hydrogen, =62,032 units.
Deduct latent heat of 9 lbs. vapor, of 70°, 1065°..... = 9,585 "

Heat effect of 1 lb. of hydrogen, without condensation of vapor..... =52,447 "

These estimates of the heat of the flame of gases have taken for granted the constancy of the relative values of specific heats at high temperatures, and the results may therefore be considered as only approximations of the truth; still they give, probably, the most nearly correct estimate of the values of intensity possible.

The heat evolved by the burning of coal gas is dispersed in two ways—as radiant, and as convected or imparted heat. With the open burner, it is fair to assume that a large portion of the heat is dispersed as radiant heat. According to Peclet, 50 per cent. of the heat of a flame of burning wood or coal is dispersed as radiant heat, and it does not seem to be an improper assumption, that one-half of the heat of burning of coal gas will be dispersed as radiant heat, and the other will be communicated to the gases of combustion, and disseminated by convection and intermixture with the surrounding air. The limited base from which the flame of a gas burner emerges, as compared to the magnitude of the flame or burning surface, prevents the loss or expenditure of radiant heat upon the fuel (which would again impart its heat to air in contact before burning), and thus reduces the convected heat to its least quantity. The supposition appears the more reasonable when we consider the enormous intensity of the heat of chemical combination; nearly 14000°, as above indicated, when unmixed with other gases to absorb its heat. If we proceed upon this supposition, it follows that the convected heat of 100 lbs. of coal gas becomes one-half of 1945400 =972700 units; and this heat imparted to the products of combustion,

when they are taken to include the volume of air necessary to effect complete combustion, gives the temperature of these products:

$$=\frac{972500}{756{\cdot}572}+70^\circ=1356^\circ.$$

The relations of volumes of the products of combustion of coal gas to the weights as ascertained, can be seen by the following table estimated at 70°:

Product	Spec. grav.	Wt. per cu. ft.	Cu. ft. per pound.		Wt. of product.	C. f. of product.	Cu. f. per ft. of gas.	Vol. per ct. of product
H_2O	0 622	0·0466	21·45	×	198=	4247	1·355	10·45
N	0·972	0·0729	13·73	×	1117=	15332	4·891	37·73
4N + O	1·000	0·0750	13·34	×	1436=	19158	6·111	47·15
CO_2	1·524	0·1142	8·754	×	217=	1900	0·606	4·67
					2968=	40637	12·963	100·00
Gas	0·426	0·0319	31·35	×	100=			7·71
Oxygen*	1·106	0·0829	12 07	×	319=	3849	1·228	9·47
Air	1·000	0·0750	13·34	×	1432=	19103	6 094	47 01
Dbl' air	1·000	0·0750	13·34	×	2868=	38259	12·204	94·15
Heat total, units				1945400			622	
Heat convected, units				972700			311	

* The oxygen taken is that of actual combination, and represents the quantity needed, with coal gas, when used for the lime light or Bunsen burner.

The preceding computation can be verified by another arrangement of data, in which volumes alone appear, taking the second column from the table of reduction of volumes to weight:

	100 vols. × spec. grav.	H.	C.	O.	N.	
Hydrogen, H	3·114	3·114				
Marsh gas, CH_2	20·124	5·031	15·093			Result of combustion of hydrogen and carbon with definite proportion of oxygen
Olefines, C_2H_4	7·848	1·121	6·727			
Carbonic oxide, CO	5·802		2·487	3·315		
Carbonic acid, CO_2	3·048		0·831	2·217		
Air, 4N + O	2·000			0 444	1·556	
Aqueous Vapor, H_2O	0·622	0 069		0·536		
						H_2O CO_2
100 vols. × spec. grav., totals	42·558	9·335	25·138	6·529	1·556	
Per cu. ft. gas, weights, lbs.	0·0319	0·0070	0·0188	0 0049	0·0012	0·063 0·069
" " vols., cu. ft.	1·000	1·349		0·059	0·017	1·351 0·605

In general, the combustion of all substances, oils, fat acids, or gases used for illuminating purposes, is unquestionably perfect combustion of the carbon and hydrogen elements into carbonic acid and aqueous vapor. Neither smoke nor carbonic oxide, nor hydrogen in free or combined state, other than water, can be found in the air of any room where the lighting is at all satisfactory to the occupants, and the production of heat, as has been estimated, becomes one of the positive facts in physics beyond question as to existence and quantity. With the case of the open gas burner, it is possible that one-half of the heat of the flame is dispersed as radiant heat, but this dispersal does not, however, get rid of the heat in a room; it merely transfers it to solid bodies of less temperature, more or less remote from the flame, which are again cooled in great measure by contact of the air of room, which takes up their excess of warmth, so that the heat emanating from a burner really is nearly all expended in the air. But when the burners are shaded by glass or other shades, and particularly for argand burners with chimneys, the larger part of the radiant heat is cut off by the shade or chimney, or both together, and imparted to an unknown volume of air which accompanies the air for or of combustion. As a practical application, it may be well to consider what volumes of air are requisite to disperse the heat of gas lights if the air in any part of a room is limited to some definite temperature.

The following table exhibits the effect of gas burning from a single burner of the usual sizes.

(All figures refer to quantities per hour—air of rooms and gas at 70°.)

Gas burned, cu. ft.		1	3	3½	4	4½	5	6	8
Carbonic acid evolved,	cu. ft.	0·606	1·82	2·12	2·42	2·73	3·03	4·24	4·84
Aqueous vapor "	"	1·355	4·07	4·74	5·42	7·10	7 78	8 13	10 84
" " "	lbs.	0·063	0·19	0·221	0·253	0·285	0·317	0·38	0·506
Oxygen removed, cu. ft		1·228	3·68	4·30	4·91	5·52	6·14	7·37	8·60
Heat produced, units		622	1866	2177	2488	2799	3110	3732	4976
Coal to produce equal heat, lbs.		0·062	0·19	0·22	0·25	0·28	0·31	0·37	0·50
Air supply=10 cu. ft. per min per c f of gas	cu. ft	600	180)	2100	2400	2700	3000	3600	4800

With the supply of air to each gas burner given by the preceding table, the temperature of the current ascending from open burners, where one-half the heat is supposed to be radiated away, becomes 99°; while the temperature of the same current arising from an argand burner, where the glass chimney will have intercepted the radiant heat, becomes 128°.

The figures for this temperature are thus obtained: The weight of air at 70° is 0·075 pound per cubic foot, which, multiplied by 0·238, the specific heat of air, gives 0·01785 unit as the capacity of one cubic foot of air for each degree Fahr.; with 600 feet of air supply per hour to one foot of gas, the capacity of the 600 feet becomes 10·71 units for each degree of elevation of temperature; and to absorb 622 units by the 600 cubic feet of air, the latter will become heated—

$$\frac{622}{10{\cdot}71}=58^\circ,$$

which, added to the 70° of primary temperature, give 128° as the final one, when all the heat is taken up by the air. When but half the heat is assumed to be given to the air, we have 29°+70°=99°.

The computation of the temperature to accompany any other volume of air supply is easy. Thus, if for each cubic foot of gas burned per hour—normal temperature 70°:

Air supply per minute, cu. ft	5	10	15	20	25	30
Corresponding air supply per hour, c. f.	300	600	900	1200	1500	1800
Temperature of air ascending from open burners	128°	99°	89°	84½°	81½°	79½°
Temperature of air ascending from argand burners	187°	128°	118°	99°	93°	89°

The estimate of weight of coal, the consumption of which will produce an equal effect in warming a room with gas burning, is not based on the theoretical value of coal as a producer of heat, but upon average usual results from heating apparatus, as steam or hot water apparatus, hot air furnaces of best construction, or close stoves, in utilizing the heat of the fuel. That is, 10,000 units of heat have been assumed to be given out efficiently by the consumption of one pound of good anthracite coal.

The capacity of the air requisite for dispersal of the heat of a gas flame to take up the moisture generated by the process of burning, can be investigated. According to the best authority (Regnault, from Guyot's tables), saturated air has the following quantities of moisture per cubic foot of air:

Temperature of air,	70°	75°	80°	85°	90°	95°	100	105°
Weight of moisture, lbs,	0·0011	0·0013	0 0016	0·0018	0·0021	0·0024	0·0028	0·0032

If it is assumed that the air of supply is 70°, and has 60 per cent. of saturation, then such air has 0·0007 pound of water to each cubic foot, whence the capacity of this air, to take up moisture in becoming saturated, is:

0·0004 0·0006 0·0009 0·0011 0 0014 0·0017 0·0021 0·0025

and there will be needed to carry off the 0·063 lb. of moisture which the burning of each cubic foot of gas per hour evolves:

Air at given temperatures, cu. ft.	158	105	70	57	45	37	30	25

Comparison of these quantities, with the volume of air supply, and corresponding resulting temperatures as given in the previous table demonstrates that the moisture generated by gas burning will be absorbed, in all cases, into the air for dispersal of heat.

While it appears to be impossible to discern any error in the method and data of this inquiry, and the mathematical accuracy (errors of computation excepted) of the results seems to be unquestionable, yet their application to practice is found to need great qualification. The material products of combustion, *i. e.*, aqueous vapor and carbonic acid, and the corresponding abstraction of oxygen from the air of a room, are established facts, but it is very difficult to account for the dispersion of the heat. Great allowance is needful for conductivity of the enclosing surfaces—floors, walls, ceilings, windows, and doors—and also for fresh air currents, surreptitious or otherwise, before the heat imparted to the air, as is derived from these computations, will conform to what is really found to be the heat effect of gas-lighting. For instance, a four feet gas burner would be held to be ample for lighting a small bedroom, and such a burner is frequently permitted to remain burning all night in a room of, not to exceed, 800 cubic feet capacity. This burner, by the computation, would produce 2488 units of heat each hour. In moderate weather no considerable loss of heat from the surfaces of the room is supposable, and the figures give 7,200 cubic feet of air per hour (or 120 feet per minute) as the indispensable necessity to keep down the temperature to 19° above the normal one. To be sure, the current of gases ascending from the burner will reach the ceiling of the room at a greatly elevated temperature, perhaps 140° even, and a stratum of hot air next the ceiling be formed (unless some arrangement of ventilation removes the hot air at once) and then the conductivity of the ceiling will be brought into action, but yet it is hard to feel satisfied that this means is sufficient to account for all the loss of heat apparently demanded.

It must be admitted that further inquiry and experiment are wanted to elucidate the subject of the dispersal of heat of gas-lights, and perhaps to review the entire subject of the quantity of heat produced by them.

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TUESDAY, APRIL 2, 1878.

Official Report of Examinations of Gas for three Weeks ending Mar. 30, 1878, made at the Photometrical Room of the Department of Public Works.

Corrected Illuminating Power.

Date. Mar. 1878.	Time of Day at which Test were made.	New York Gas Light Co.	Manhattan Gas-Light Co.	Mutual Gas-Light Co.	Metropolitan Gas-Light Co.	Harlem Gas-Light Co.	Municipal Gas-Light Co.
11	Between 10 A. M. and 3 P. M.	17.18	18.24	21.30	16.12	16.38	
12		18.52	17.86	22.08	16.01	16.08	
13		16.63	18.37	21.80	16.60	15.83	
14		17.82	17.18	21.74	16.15	16.15	
15		16.54	19.03	21.99	16.38	16.48	
16		18.87	18.14	21.68	16.20	16.32	
	Average	17.59	18.13	21.76	16.24	16.20	
18		17.16	17.01	20.70	16.58	16.27	
19		17.21	18.17	22.04	17.56	16.30	
20		16.31	17.54	20.04	17.69	16.72	
21		16.17	17.96	21.20	16.42	15.70	
22		16.71	17.64	20.05	17.12	17.21	
23		17.71	17.58	20.23	17.47	18.42	
	Average	16.87	17.65	20.71	17.14	16.77	
25		15.76	17.36	19.70	17.21	18.29	
26		16.76	17.80	19.86	17.02	18.52	
27		17.18	17.67	20.00	16.14	17.80	
28		16.87	17.45	20.93	16.88	17.57	
29		17.41	16.70	20.64	16.70	17.52	
30		16.90	16.44	19.67	16.40	18.10	
	Average	16.81	17.23	20.13	16.72	17.96	

Sugg-Letheby burner.
E. G. LOVE, Gas Examiner.

Eighth Annual Meeting of the New England Association of Gas Engineers.

[OFFICIAL REPORT.]

[Continued from page 118.]

AFTERNOON SESSION.

The Convention re-assembled at 3½ o'clock, P. M., the President in the chair.

The President—Mr. Malcolm S. Greenough, of Boston, has some figures to present to you, which are short and to the point, and which I have no doubt will be of interest to the Association.

CHARGING ALTERNATELY.

Mr. Malcolm S. Greenough—Gentlemen: The figures to which the President has referred, are some which were made for our own satisfaction, and relate to a subject on which it is probable that many of you have previously experimented.

It is, I believe, the custom with most managers, and it certainly has been our own, to strike three retorts vertically at one time, and draw and charge them; then to take the next three in order and so on through a bed of twelve. We have been trying to improve on this method by charging but three retorts at a time in a fire, and waiting two hours before disturbing the other three, and the results obtained speak for themselves. They were obtained from a bed of twelve retorts in ordinary use, the gas from which can be separately purified and measured.

We first started with a charge of 2400 lbs. of coal to the bed (200 lbs. per retort), and run six successive charges, obtaining a yield of 17,530 cubic feet to the bed, or 6,310 feet to the retort, or 5.17 feet to the lb. of coal.

These retorts were drawn and charged in the ordinary manner. In order to make a comparison between that method and the one with which we were experimenting, it was necessary to run the retorts on the second occasion twenty-eight hours continuously, the product of the first and last two hours being disregarded. We then found that while using the same amount of coal, instead of making 5.17 feet to the pound, we made 5.29; the yield per bed being 76.320 feet per 24 hours, and the yield per retort being 6360, a gain of 150 feet per retort for the 24 hours, a small quantity in itself but a large one at the end of the year. We then made our charges 100 lbs. heavier for the 12 retorts (2500 lbs.) and we obtained by the method in which we ordinarily run them 76,200 cubic feet in the 24 hours, 6,350 feet per retort, or 5.08 feet per lb. A less yield than we had previously obtained by the other method when using 100 lbs. less coal, and on using the same weight of coal, but charging only half the retorts at a time, we made 6616 feet per retort, or 266 feet more than we had obtained by the other method. The same was proved to be true in using still heavier charges. We tried it with 3600 lbs, and with 2700 lbs. and we found that with 2600 lbs. charges we made 290 feet more to the retort in 24 hours, when working by the new method than by the old, and we made 137 feet more per retort with 2700 lbs. charged when working by the new method, than from the same weight of coal by the old.

The retorts on this occasion were hotter than they had previously been, and the yield per lb. was greater by the old method than it had been with the lighter charges. But the difference, as you see, was marked on every occasion that we tried it, in favor of the new method.

Before concluding, let me say that I have no doubt of there being many gentlemen present who have long been familiar with these facts, and to them I should apologize for taking up their time. But if any gentlemen here are in the same condition as ourselves and are charging their benches as we have always done, to them I hope these figures may be of some interest,

Table showing result of Experiments upon the Entire and the Alternate Methods of Charging two Benches of Sixes, 24" × 14" × 8' 6". Pressure due to ⅜" Seal reduced by an Exhauster to ⅛". Coal, dry Penn. taken from the pile without selection. Tests made at the Works of the Boston Gas Light Co., by Mr. Malcolm S. Greenough, in November, 1877.

Date.	Method.	Wt. of Each Charge. Lbs.	Yields for 24 hours.	Per Lb.	Per Retort.	Difference.
Nov. 8 & 9.	Old style.	2400	74,530	5.17	6210	
" 9 & 10.	New "	2400	76,320	5.29	6360	150
" 12 & 13.	Old style.	2500	76,200	5.08	6350	
" 13 & 14.	New "	2500	79,400	5.29	6616	266
" 17 & 18.	Old style.	2600	78,880	5.05	6573	
" 18 & 19.	New "	2600	82,360	5.28	6863	290
" 23 & 24.	Old style.	2700	83,100	5.13	6925	
" 26 & 27.	New "	2700	84,750	5.23	7062	137

Mr. Harbison—I would like to ask whether you have observed the difference of temperature in the two hours by the two methods of charging, and if so, what it was?

Mr. M. S. Greenough—I made an attempt to determine that, but I was not entirely satisfied with it I do not think the difference was very great. I made some tests every half hour, charging by the new method, and I found the figures were very similar to those which I made last year when the old one was in use. In fact the figures were so nearly alike that their similarity was remarkable. I afterwards attempted to make others, but the cold weather which set in very much affects the heated iron as it is withdrawn from the retorts, and the decision to which I came, to read no paper on this subject, prevented my going on with it. The figures which I did make may be of some interest. Let me first state that our retorts are not as hot as they were last year. We are charging them somewhat more heavily, and we do not think the setting has been quite as successful, starting then at 9.30 with a temperature of 2086°, at 10 o'clock the temperature had fallen to 798°. The iron was placed on the coal and partly buried in it. Of course it is impossible to say just how far it is buried, for the flame which at once arises when the retort is opened, prevents our seeing just the position of it. The iron is hooked on the end of a rod and thrust on to the coal, and when it is withdrawn another is pushed into its place, as near as can be determined. The difference in the position of the iron might well make a difference of 100° or more in its temperature, but that the process (as explained last year, see AMERICAN GAS-LIGHT JOURNAL, vol. xxvi, page 102) will show approximately the heat to which the coal is exposed, I have no doubt. To resume then. In half an hour the temperature had sunk to 798°. In an hour it was 1450°, at an hour and a half it was again 1400°: in two hours 1664°; at third hour not taken; in three and a half hours it was 1980°; in four hours it was 2149°

Let me now read an experiment I made last year, in which the temperature was taken every hour. It was higher at starting, being

At the start, 2289°.
At the end of one hour, 1403°.
" " two hours, 1660°.
" " three hours, 2113°.
" " five hours, 2210°.

I think, gentlemen, that the similarity of these figures shows that they are something more than accidentally so, and while they may not show the tem-

perature of the *retort* they certainly show that to which the coal is subjected.

Col. Armington—I don't know that I can substantiate the figures that Mr. Greenough has given. I have been practising that thing for one year with benches of sixes, charging half a bench at a time right through the house. My estimate is a gain of a thousand feet a day to a bench. The superintendent of the Manhattan Company told me that he did not make that difference; but I am satisfied that there is that difference in charging only half a bench at a time. I mean a bench of six retorts.

The President—Is there any other matter on this paper of Mr. Greenough which members wish to introduce? If not, Mr. Greenough will accept the thanks of the Association for presenting the statement to us.

Mr. Allyn—I might add one word more upon this matter. About two years ago I adopted the plan of charging three retorts every two hours. Instead of charging three on the same line I charged the two upper retorts on one side, and the lower retort on the other, and the next two hours *vice versa*.

Mr. Harbison—I have been carrying out this practice for a long time, and I am satisfied that Col. Armington's figures are correct—in his estimate—in obtaining a thousand feet to a bench, more per day, from charging three retorts in a bench at a time. I charged one on one side of the arch and two on the other; and I am satisfied that it has a great advantage over charging the whole bench. There is an additional reason—that you have not the retorts lying idle so long a time. In charging you don't need to have so many retorts open, because they are scattered more over the house. It is impossible for my men at any season of the year to get more than twelve retorts open at a time. They are all three open in the first bench. Before they get all three drawn in the third bench they are charging the first bench.

Col. Armington—We want to get at the facts. Some gentlemen say they do their work in this way. I would like to know from them how long it takes to draw and charge twenty-four retorts.

Mr. Harbison—I have drawn and charged twenty-four retorts in about eighteen minutes, in the winter season, from the time the first lid is struck until the last is sealed up. I charged them with the shovel.

THE SEMI-ANNUAL MEETING.

The Secretary—It has usually been our custom to choose a committee at this annual meeting of the Association to report, after due consideratiun, a place for holding the semi-annual meeting.

The President—Is it your pleasure that we take action upon that subject now, that the committee may be in session while other business is being transacted?

Mr. Gerould—I had hoped, if the Association conclude to hold a semi-annual meeting, that those parties who know of the meeting and decide to attend to attend the same, will be present this year and pay their assessments, instead of staying away as they did last year and making the Association pay it.

The President—The remarks of Mr. Gerould are to the point, for all understand them. Will the Association take any action at the present time? Shall the matter of a semi-annual meeting and the place of holding it be referred to a committee to report at this meeting, or else to report to the members at some other time—what is your pleasure in regard to it?

Mr. Rollins—I move that a committee be appointed to decide upon a place of meeting, if we are to have a meeting in August.

Mr. Cabot—Will it not be better to decide whether we will have one first?

The President—The question to be decided is—whether the Association will hold its semi-annual meeting, or dispense with it?

Mr. Cushing—I move that we hold our usual semi-annual meeting in the month of August.

A vote was taken and the motion was adopted.

Mr. Rollins—I move that a committee be appointed to determine the place of meeting. Carried.

The chair appointed as that committee Messrs. Rollins, Cushing, and Coggshall, and they retired for consultation.

The President—We will now listen to the paper which has been prepared by Mr. Sherman.

THE REMOVAL AND PREVENTATION OF CARBON.

BY F. C. SHERMAN.

The subject of this paper is so familiar to all gas engineers, that it may appear almost superfluous to bring the subject under the consideration of a meeting like the present. But from observation I am satisfied that some of us can improve on our present methods and apparatus for the removal and preventation of carbon. I do not propose to go into any scientific discussion in regard to its formation in our retorts. It is conceded by all that its formation is chiefly due to mechanical pressure. This, I think, was clearly demonstrated by Mr. Grafton at the Cambridge, England, gas works. The record of his experiments are familiar to you all. The engineer who would get the best results attainable, must keep his retorts comparatively free from the accumulation of carbon.

Our retorts are 14" × 24" 9 feet long, and contain 18 feet floor surface. When the retorts are free from carbon we average 360 cubic feet of gas for each foot of retort floor surface. Our retorts take on carbon so gradually that, almost before we are aware of it, their capacity is reduced from 10 to 20 per cent., with the consequent loss of labor, fuel, and increased expense for repairs. Here, as elsewhere, in the details of our business, the price of success is constant watchfulness. There are various methods of removing carbon from retorts, but there can be no question that the one known as Edge's is far in advance of all others, and leaves very little room for improvement in this direction. Mr. Edge recently informed me that he kept the carbon in his retorts down to that point that only four hours was needed to remove it, with his process. Now, here is where many of us who have his process, fail to obtain the best results from it. We allow the carbon to accumulate until it takes twelve hours or more to remove it, and then are amazed that we don't get the results that Mr. Edge, and others who follow his instruction, get. No coal gas company can afford to get on without Edge's process to remove carbon from their retorts.

While it is not possible to get on without making some carbon in our retorts, it is possible by proper appliances to reduce it to a minimum. Grafton, forty years ago, in his experiments, made clear the source from whence this accumulation in our retorts comes and also applied the remedy; and it is not much to our credit to add that with the record of his experiments before us. exhausters did not come into general use until within the last eight years. Within the last seven years a member of this Association told me that he could not sleep nights if he had an exhauster in his works. By removing the dip seal pressure it is possible to get on without having to remove the carbon from retorts oftener than once in three months. To remove prejudice, and to prove that working without dip seal is not a modern invention to destroy our works, and the quality of our gas, allow me to quote from the record of the proceedings of the British Association for 1868. Upon the subject of removing carbon from retorts, Mr. Essen of the Cheltenham works is reported as follows: "It was known to many of the members that for some years he had had retorts in action without any seal. He should certainly never think of introducing a seal between the exhauster and the vessel in which the coals were carbonized. In this way he could go on from the time he lighted up in autumn until he let down the furnaces in the spring, without any of those ingenious processes for removing carbon which had been referred to."

After describing the apparatus which he used to dispense with the dip seal he goes on as follows: "Although it seemed rather a dangerous proceeding, he might state that he had had it in use for twelve or fourteen years, and never met with the slightest accident. Only on rare occasions had he to burn out the carbon."

The President of the Association, Thomas G. Barlow, in summing up the discussion, remarked as follows: "The discussion that had followed the reading this paper left him very little to say. He might, however, remark that he thought Mr. Essen had hit the right nail on the head when he said that the remedy for all the inconvenience was to go to the source of the evil. And as it had been proved over and over again by careful experiments, that distillation under pressure was the means of increasing the quantity of carbon, their attention shou'd be directed to the mechanical appliances by which that pressure can be removed."

The records of the British Association for 1877 show that they still work in the Cheltenham works without dip seals.

The loss of time, fuel, and repairs occasioned by the removal of carbon is an important item in our manufacture, and if this paper shall be the means of calling attention to this subject, and of reducing the expense of removing it, I shall be amply rewarded for preparing it.

The President—The thanks of the Association are due to Mr. Sherman for his interesting and valuable paper. This whole subject is before you gentlemen, and I would state to our honorary members and to our friends and associates from the other parts of the United States that we would be happy to have them join with us in our discussions and deliberations, if they see fit.

The Secretary—How often, Mr. Edge, do you remove the carbon from your retorts?

Mr. Edge—I remove the carbon every thirty days. We make that a rule, however much or little there may be in the retort. In fact if it was removed more frequently I think it would be more beneficial. The time occupied in removing it is about in proportion to the quantity you have to remove. If you remove it about every twenty days, probably it would be beneficial, instead of leaving it for thirty days. I think no accumulation should be allowed which will require more than four hours for removal. Of course there is a great difference in the accumulation of carbon in the retorts. With some who work under a very light seal, the carbon does not accumulate so fast. With others, whose dip is greater, the accumulation is more rapid. Where you work without a seal, the accumulation in thirty days would be so slight, that it would be removed probably in two or three hours. But the removal of the seal will lessen the accumulation of carbon probably one half; and the increase will be about in proportion to the dip. Probably where the drocess is carried out carefully, not over one per cent of the retorts need be idle.

The Secretary—What is your experience with the retorts after the carbon has been burned off, as to their condition—do you find cracks in them?

Mr. Edge—By long continuous heating of the material it shrinks, and you will have cracks in the retorts. I don't think it is possible to run a retort two years without its cracking. Generally at the expiration of a year you find cracks in the retort every time the carbon is removed.

If you burn with air then the carbon is removed from the clay or body of the retort, and there is a second leakage attending that. But where you burn with steam, or the combination of air and steam, as soon as the carbon is removed from the interior surface of the retort the steam comes in contact with the clay, and no combustion or removal of carbon from the body of the retort takes place after the carbon is removed from the surface; consequently when you charge a retort after removing the carbon by steam, it is in a perfectly sound and healthy condition, because the carbon has not been removed from the substance of the retort, and the strength and durability of the retort depends entirely upon retaining the carbon in the body of the retort. But if the process with air is used the carbon is removed entirely

from the body of the retort and leakage results. That is my experience with carbon in retorts.

Col. Armington—Don't you think that when a retort is working without a seal it is constantly being de-carbonized?

Mr. Edge—That would depend entirely upon the pressure. If the pressure upon the retorts were removed continuously, there would be no accumulation. I consider it necessary to keep two or three-tenths of an inch pressure on the retort—to bake the carbon on and keep it on. As soon as you remove the carbon from the clay the retorts become exceedingly weak, and retorts worked upon that principle would not last more than six or eight months before they begin to crumble. If the other method is used they have all the solidity of iron, and it maintains them in a perfectly sound condition.

Col. Armington—That being your opinion, would you recommend the removal of the seal from the retort?

Mr. Edge—I would not, unless pressure was maintained sufficient to keep the carbon in the body of the clay. Does that answer your question?

Col. Armington—It does, sir, perfectly.

The Secretary—With your permission, sir, I would like to ask Mr. York what his experience is with carbon when working without the seal.

Mr. York—I think the carbon on my retorts does accumulate a little, and I attribute it to the oscillation caused by my exhauster, and the manner in which I exhaust. I exhaust in my works, in school-boy phrase, with the "cart before the horse." My gas enters the washers first and the condenser next, and then the exhausters. This causes an oscillation of three or four-tenths pressure off and on the retorts, and I have no donbt that that is the cause of the accumulation of carbon there. If I had my way I would fix it so that the gas would be drawn off regularly. In that case I scarcely think I would have had any carbon deposit. If I required a little for the purpose of filling up the pores I could have a one-tenth pressure on. With that I think I need have no carbon on the retorts, except in order to fill up the pores. Of course if there was no air drawn on from the furnace the loss of illuminating power would tell the tale. It will greatly deteriorate the value of the gas as an illuminator, and the gas would show it. Now we try to keep our candle-power to 17 candles, though it sometimes gets down to 17½. The lowest my gas has been this winter was one day when it was down to 15½, and I attributed that to the coal that I was using—Newcastle coal. I don't think it was superior coal. But so far as the accumulation of carbon was concerned, I don't think we would have had any, if the pressure had been entirely removed during the process of carbonization; and I think the candle power would be a great deal benefitted by it. That is all that I can give you from my experience upon the subject; of course the increase in the yield is in proportion to the amount of carbon that we keep in the gas.

Col. Armington—Our guest, Mr. McIlhenny, of Washington, D. C., has had a great deal of experience in these matters. We should be very happy to hear from him.

Mr. McIlhenny—I am entirely surprised to be called upon, as I came here to learn and not to teach others. But the question of carbon always interests me, no matter where I am, or under what circumstances. And I am always gratified to find that the fraternity are becoming entirely unanimous in the opinion that the formation of carbon could be prevented. Some ten years ago, I don't say that I started the original idea, but I did start the question in this country as to the propriety and expediency of maintaining a seal on the dip-pipes. I satisfied myself by experiment that it should be entirely abolished. I published a circular on the subject, and got a patent for a way of accomplishing this object. There were very few persons then in the gas business that agreed with me. Most of them raised objections. Some said that it could not be done. Others said there was great danger in doing it. But it has been demonstrated that it can be done, and that there is no danger in doing it. The works with which I am connected have been running without a seal for ten years. The results at these works can be ascertained by any person, and will compare (I say it, I think, without egotism) with most works in the universe. I attribute their success to that consideration almost entirely. The very moment that we quit using the seal our results went up, and the quality of the gas improved. For some time after we abolished the seal we had some little difficulty in getting a mechanical device that was perfect in controlling the pressure; but we did contrive a mechanical device in the way of a governor that perfectly controls the pressure, and we now run our pressure exactly at zero. Gentlemen that have visited our works can testify to that fact, that we can run our retorts almost indefinately without cleaning them out, if we choose. We clean them out sometimes because we have a large number of lamps that are off seven days in the month. Then some of our retorts are idle and we clean them out. I have the honor to say that I was the first person that bought our honored friend Mr. Edge's patent for that purpose; and when you want to clean retorts I will add my testimony that there is no method that I know of so effectual and so expeditious as that. I think I bought it before Mr. Edge used it himself.

Mr. M. S. Greenough—How long do your retorts last?

Mr. McIlhenny—From fifteen months to two years.

Mr. M. S. Greenough—You don't find this deterioration of which Mr. Edge spoke?

Mr. McIlhenny—We do not. Our retorts do not last as long as some people's; but we use them very severely. I would say, in addition to what I have already said, that we have no trouble in our works at all with stopped stand pipes or anything of that kind. And, as I said before, we can run our retorts almost indefinitely without cleaning them out. We never diminish the charge at all on account of the accumulation of carbon. We keep right along until the retort is worn out.

Capt. Dresser—Do you have any accumulation of carbon?

Mr. McIlhenny—We have a little on the lower corners of the retort and on the back end. My views were very explicitly set forth in a paper on that subject, that I read in Cleveland at the first annual meeting of the National Association. I gave it then as my opinion, that if coal continued to be the material from which gas was made, dispensing with the dip-seal would be universal. I think I have lived long enough (although not a great while) to witness the fulfilment of that prophecy, because I think nearly everybody now who is using retorts keeps on a little seal from *principle*. They are trying to accomplish it. They are working up to that condition of faith after a while. But I notice that those who run without a seal produce the best results. I think that if the works were all taken they will average better results by far where they are run without the seal than when they are run with the seal. And then for another consideration. In running without the seal there is the satisfaction of knowing that you can run right along without being interrupted by the retorts choking up every three or four weeks, and being obliged to apply the steam, or some other process, to clean them out. That is a great satisfaction. And then, of course, there is the consideration of the smaller number of benches that you are obliged to employ. Those are matters of figures; and I think the true principle was shown in that paper that I read in Cleveland. I am very much gratified to see the universal testimony in favor of my plan, on this subject. Mr. Forestall read at Cincinnati a very interesting paper, which all of you gentlemen have probably seen (see AMERICAN GAS-LIGHT JOURNAL, vol. xxvii, page 8) demonstrating the utility of dispensing with the seal on the dip-pipe. I think that all those who have tried it with intelligence and care can testify to the same results.

Col. Armington—I think this testimony is right to the point. But I think Mr. McIlhenny skips over one place in referring to the published proceedings of the society at Cincinnati. This fact was mentioned by Mr. Forstall, that by the removal of pressure from the retorts they accumulated no carbon. One gentleman from Pittsburgh, who removes the seal from the dip-pipes, says that by that process he made more carbon than ever he did when he ran with a seal.

Mr. McIlhenny—I visited Pittsburgh just before I went to Cincinnati. I saw the immense piles of carbon that Mr. McElroy had manufactured, and I heard his statement in Cincinnati. I am very well satisfied that Mr. McElroy did not run without a seal. He had a contrivance in the top of the pipes—a valve—which it required four or five men to turn, and in my presence they broke a large chain in the attempt to turn it. So I am very well satisfied that Mr. McElroy was deceived; that he did not run without a seal as he supposed he was doing. I think that is the secret of his having so much carbon, although he was very confident that his valves were all in good working order. There have been a great many devices, of course, for accomplishing this purpose, and everybody thinks his own the best.

Capt. Dresser—How did Mr. McElroy's gauges stand on the mouth-pieces?

Mr. McIlhenny—That I did not see. The retorts were nearly all leaking when I was there. They said that they had a very large accumulation of naphthaline, and they were putting on pressure to see if they could not diminish it.

Capt. Dresser—I saw Mr. McElroy's works with guages on the mouth-pieces. They stood exactly at zero, uniformly, without any pulsation throughout the retort house. The universal testimony is that where there is no seal there will always be a slight accumulatian of carbon, but that it will be very largely diminished, and almost entirely done away with.

Mr. York—I should like to hear from my friend, Mr. Warren, of Manchester, who has for the past few months run without a seal.

Mr. Warren—We bought the McIlhenny process more than a year since, and have worked it ever since very satisfactorily. We have had no trouble at all from the accumulation of carbon. In the last week we let down a bench that had been running seventeen months, and there was but vere little carbon in it. Before we dispensed with the seal we had more or less accumulation of carbon; and it was quite a process burning it out. But since we have used the McIlhenny process we have not removed the carbon at all; we have had no occasion to. Many of our retorts are as free from it to-day as they were when they were started.

Mr. York—What do they attribute that to To dispensing with the seal, or something else?

Mr. Warren—I know of nothing else. We have made no further change than dispensing with the seal.

PLACE OF SEMI-ANNUAL MEETING.

Mr. Rollins—The committee to whom was referred the subject of the place for holding the next semi-annual meeting, have decided to recommend that the Association meet at Hartford. Perhaps the date might be left to depend something upon the time o the holding of the Horse Fair, as that will add to the inducements for members to be present, and promote a full attendance. We are promised a steamer to convey us where we like, free of charge.

The President—You hear the report of your committee. It is in effect that the meeting be held at a time to be determined by the Board of Directors. What action will you take upon the report? Shall the report of the committee be accepted? If there are no further remarks to be made the question will be taken.

A vote was taken and the report of the committee was accepted and adopted.

The President—Shall the time of holding the meeting be left with the Directors of the Association?

Mr. Gerould—I make a motion to that effect.

Mr. Harbison—The vote on deciding to go to Hartford was so light that there may be a doubt in the minds of many gentlemen as to whether they had better go to Hartford at the time of the Horse Fair. If there are a number of gentlemen that would prefer to go at some other time, I hope they will so express themselves. If the place is not entirely satisfactory to the members of the Association I hope they will decide on some other place. If it is worth while holding a semi-annual meeting, it is worth while to do it at some time and place when and where the most of the members can attend.

Mr. Cabot—The time is left entirely in the hands of the Directors of the Association, and they can determine whether it is best to go at the time of the Horse Fair, or at some other time.

Mr. Rollins—I believe last year the matter was left with a committee consisting of the Secretary and two others, to make the arrangements, and fix the time for the meeting; and I move that a committee for that purpose be appointed for this year.

A vote was taken and the motion was adopted.

The President appointed as members of said committee, Messrs. Rollins, Cushing and Coggshall, with the addition of the Secretary.

STATISTICS.

Mr. Gerould introduced a resolution to the effect, that any coal gas engineer in the United States should upon request be furnished with a copy of the tabulated statistics upon the condition that the engineer so requesting a copy should, before July 1st, 1878, file with the secretary, answers to the questions contained in the circular, as shown by the books of the company to which he belongs.

This led to a long discussion, and several amendments were offered, and finally, upon motion of Mr. Stedman, the pending resolution was laid on the table.

Mr. Harbison—I move that a Committee on Statistics of last year be appointed for the ensuing year with instructions to collect statistics for this year. Carried.

Voted that the resolution of Mr. Gerould be taken from the table.

Mr. Gerould—I wish to amend the resolution offered by myself, by striking out the words "any engineer of any coal gas company in the United States," and substituting the following words: "any coal gas engineer from any part of the United States who may be present at this meeting."

After further discussion the motion of Mr. Gerould, as amended above was adopted, with a further amendment, that additional returns must be sent in within ten days, to entitle those sending them to a copy of this year's statistics.

The Secretary—We have spent a good deal of time discussing this matter of statistics. I am delighted to find that our work is appreciated. I think it is a very valuable document indeed. Something has been said with regard to members withdrawing their returns. I would like to see them do it. The matter is put into my charge, as secretary. I will return the original copies, but that table which now hangs on the wall before you they cannot have. Now, with the assistance of the committee, I will have these returns made up and ready for printing as soon as possible.

DECEASED MEMBERS.

The Secretary—At the semi-annual meeting allusion was made by the President to the decease of William H. Perry and R. R. Harriman, members of the Association, and the former, one of our directors. A committee was appointed to draft suitable resolutions and present them to the annual meeting. The committee have attended to the duty assigned them, and have prepared resolutions which they request me to read. They are as follows:

Whereas, Since our last annual meeting, the hand of death has taken from our Association two of its valued members, Messrs. William H. Perry and R. R. Harriman, and it is fitting that we recognize in a proper manner, our sense of loss and our deep regret.

Therefore Resolved, That the members of this Association bear testimony to the uniform kindly and courteous character of our deceased brother engineers, to their active interest in our Association, and their high character as men and as members of our profession.

Resolved, That these resolutions be recorded in the proceedings of this Association, and a copy thereof be forwarded by the secretary to the families of the deceased members.

WM. A. STEDMAN,
JOHN ANDREW,
WILLIAM YORK. } Committee.

I would move that these resolutions be adopted by a rising vote.

The resolutions were unanimously adopted.

THE TELEPHOFE AND THE PHONOGRAPH.

Mr. Lamson—I want to direct the attention of the gentlemen present to a scientific discovery which has been of great value to the whole world, and which I believe is of value and interest certainly to all the gentlemen present. It is hardly a gas matter. But Capt. Dresser has a little supplementary matter connected with it, and I said I would just speak of it and he would follow me with some remarks—it is the use of the telephone. I am very much interested indeed in all matters connected with electricity. We have at our works quite a number of things in which we make use of this wonderful agent; but hardly any of them are so interesting as the telephone. It is, as you know, a discovery (not an invention) by Prof. Bell, and it is claiming the attention of scientific men all over the world. And if any of you gentlemen have places of business which it is desirable to connect together in a cheap and simple way, so that you can transmit messages between them, there is nothing better than the telephone. I presume it is familiar to you all. I just speak of it in order to bring Capt. Dresser's matter before the meeting. We have them between the two offices. We have them from the offices over to the holder at Roxbury, and all the holders are connected together in that way. They are very simple and certainly very wonderful instruments. Capt. Dresser will explain that supplementary matter; I think it will be all plain then. It is a matter not connected with the gas interest at all, but is a matter certainly which ought to interest anybody who is interested in science.

Capt. Dresser—Mr. Lamson has been kind enough to refer to a little instrument that I spoke to him about that might be a matter of curiosity and interest to you. It is an outgrowth of the telephone itself, and has been brought out by Mr. Edison, the electrician of the Western Union Telegraph Company. The telephone has many advantages, one of which is that when you send a message "the fellow can talk back" provided you listen. But this instrument is something where if he does not talk back the message is put on record, and at the end of any length of time—a thousand years hence—if it is taken care of, it can be dug up and by some person's simply turning the crank, the words of anybody here present may be handed down to posterity. It is known as the "speaking phonograph." It is a very simple arrangement, consisting of a cylinder with a thread cut upon it around which is wrapped a sheet of tin foil. The cylinder is about four inches in diameter. Connected with this is an arm that runs out, with a thread cut on it with the same pitch as the thread on the cylinder that holds the tin foil. The diaphragm of an ordinary telephone (*i. e.* the same as a telephone instrument) has a steel point attached to the center of it, and that is so adjusted that it just bears upon this brass cylinder, or upon the tin foil on the cylinder, and if the crank is turned this point would make a series of lines and indentations on the tin foil, such as you see printed on this sheet of tin foil which I have in my hand, the same as though you had a pin against it. And when you speak into the mouth of this telephone diaphragm and turn the crank at the same time, instead of being in a straight line, this point which is attached to it makes a series of fine dots like the head of a pin in shape, which are arranged in the form of a spiral groove, extending around the roll of tin foil from one end to the other (I don't know that any of you can see the dots on this sheet of tin foil that I have in my hand; but you can examine it at any time hereafter), and then by removing this point, turning the crank back and setting the point at the beginning of the cylinder again, and then turning the crank, this phonograph repeats distinctly every word that has been said. I saw this experiment tried at the Stevens Institute last week by Prof. Morton, before a class of fifteen or twenty students. They were standing around a long table, about as long as across this room, and every one could hear distinctly the words that were ground out on this machine, and they corresponded exactly with the words that had been repeated into it; and Prof. Mayer, who is the Professor of the department in which this has been exhibited, showed me a copy of a strip of copper that had been sent him from Washington (I think he said), of a similar record of a speech, that he said at some time he was going to put upon his machine and grind it out and see what the fellow at Washington had said. The thing is very simple, and as a means of preserving statements it is wonderfully accurate. I don't, however, see any particular practical application, though it is very interesting to look at in a scientific point of view. In order to make it available you have, of course, to speak into the mouth of the instrument. I know that men want to know about this, and I mention it as one of the latest discoveries in the telephone line.

The Secretary—I think we ought to decide now, whether we will have a meeting to-night or to morrow at 9 o'clock. Some of the members have expressed their regret that we meet for so short a time, as they come from some distance, and at some inconvenience to themselves. They say that we come together and sit here a few hours and then adjourn and go home. If there are many members that wish to remain longer I am willing to stay; and as the President will be unavoidably absent this evening, one of the Vice-Presidents can take the chair. I wish to hear some discussion relative to "test-burners"—the best burner for testing gas—the best method of getting a test of the illuminating quality of gas throughout the New England States and the United States.

Mr. M. S. Greenough—It may be proper to remark here that if any of the members would like to make a visit to our works, or our office, we would be very happy to see them at any time to-morrow that they may choose to come. We don't invite you with any special desire of showing you something which you cannot see at your own works, but only because we would like to see you.

The President—Is it the pleasure of the Association to meet this evening, or to adjourn till to-morrow?

Mr. Cushing—I make a motion that we take a recess till half-past seven o'clock this evening.

The President—Owing to an engagement that I made I must necessarily be absent this evening. I know the Association will be in good hands when in charge of the first Vice-President. Before adjourning I wish to say that the gentlemen who have so kindly brought here the electric lighting apparatus, will exhibit it immediately upon our taking a recess.

I will suggest, that in conversation with a number of members, they have expressed to me a desire to have a meeting this evening and to-morrow also, returning home to-morrow afternoon. I have no doubt that a very entertaining meeting can be continued to-morrow. There will be members enough present to make it of interest.

The Secretary—It appears by my roll that fifty-six members have been present at this meeting, and have answered to their names—a very good attendance.

A recess was then taken until seven o'clock in the evening.

EVENING SESSION.

The session of the Association was resumed at 8.15 o'clock, P. M., Vice-President Sherman in the chair.

The Secretary—As there are so many present who

are willing to spend a little time in discussing some of the subjects that are interesting to us as gas engineers, I think we had better take up some topic for discussion at once. I don't know as there is any other business to transact. Several gentlemen have left to attend a meeting in the city, and others feel somewhat fatigued; but under the circumstances we have a very fair attendance. I have something in my mind which I think might serve as a topic for profitable discussion. It relates to the best method of ascertaining the quality of illuminating gas—the candle-power. I am using a Bunsen, or as they sometimes call it, a "bar" photometer; and I am also using a jet photometer, made by the American Meter Company, at my office, and a jet photometer manufactured by the Tufts, Bros., of Boston at the works. I have guaged them so that they run very nearly alike; and my experience is that I can depend more upon the "jet" than upon the "bar." Some of my friends say "you cannot depend upon the jet at all, no matter of whose manufacture." But from experiments that I have made, with my assistants, I sometimes think that I will leave the "bar" and use the "jet" entirely, though it is better to use both, for purposes of comparison. In the table which I presented to you of the returns, some of those who have made returns gave the candle-power from observations made at the works; others at some distance from the works, at the office of the company. I have been trying some experiments, but not enough to assure myself exactly of the difference between the observations made at the same time at the works and at a distance from the works. In one trial I found seven-tenths difference, in another two, in another three. I think when the illuminating power of gas is tested at a distance from the works, in the day time, when the gas is moving sluggishly through the pipes, that there is quite a difference. But when the gas is passing rapidly through the pipes, and being consumed in the evening, the difference is not nearly as great. I think (as I said at the meeting to-day) that in the table the questions should have been put thus: That to the question, "How tested, and how often and by whom?" there should have been added "where?" I think the results would vary. The answer that I gave was, observations made about a mile from the point of manufacture, and I think that my candle-power did not show so well as it would have done if the observations had been taken at the works. I have a little feeling about that, because the State Inspector has given the candle-power of gases furnished by only a few of the companies in this State. Some are given from observations taken at the works, and some from observations taken at a distance from the works; but he does not mention whether at the works or at a distance. I think that point is very material to be ascertained.

A member—That matter is mentioned in his report.

The Secretary—I did'nt see it. But the principal point that I wished to bring before you this evening is simply the matter of testing gas, wherever it is tested, what is the best method of testing? What burner is the best to be used? Can a burner be found that will give the same results for the same quantity of gas for gas manufactured by different companies? Is it possible to find a burner that will give it? That is—when I say, as an expert says, that the quality of the Charlestown gas is sixteen candles, and of the Roxbury gas sixteen candles, would those gases, if brought together, all show on the same photometer 16 candles? They are tested with different burners of course; but is it possible to find a burner that will give the same results. I commenced this talk to bring out remarks from the gentlemen present. Mr. Jones has taken out his notes; I think he will enlighten us.

Mr. Jones—I can only say that our gas has been tested by the bar photometer and the jet photometer. It was tested at the street mains, after lying there from 6 o'clock in the morning to 8 o'clock in the day time, which I think is equivalent to more than a mile of distance—lying at the dead end. This gas remained in the 14-inch main shut off, until 5 o'clock at night.

Mr. Harbison—I would like to ask Mr. Cabot what kind of burner he uses.

Mr. Cabot—It is the Sugg London burner. I imported a series of all his burners; I don't now recollect the number. I did'nt take the test myself, because I spoiled my eyes by doing so formerly. I used to take all tests myself.

Mr. Jones—I use the London standard candle, and the Sugg burner. Sometimes I use a fish-tail and sometimes the other, and sometimes I use my broom-handle burner.

The Chairman—Do you think it is possible for any two men to read the bar alike?

Mr. Cabot—No sir, I do not.

The Chairman—Our friend, Capt. Benson, has recently imported some burners. Let us hear from him.

Capt. Benson—I feel considerably interested in the remarks made about this standard candle. I think it is very intimately associated with the results we get from our operations in manufacturing gas. One man may claim that he makes a very large quantity of gas to the pound, which is very easy to do. There is no particular merit in making a large quantity of so-called gas. The question is on the intrinsic value of what he manufactures, and the two go together. Our friend Mr. Farmer, of New York, has prepared a statement of the relation between the two—the yield and the candle-power—which is called "candle feet." When you mention "candle feet" you have a condensed statement of the result of your labors in that direction, because if you make a high yield and a low candle-power you get a smaller amount when the two are multiplied together. If you make a good yield and get a good candle-power, you correspondingly get a large indication in candle feet. The two multiplied together he has termed "candle feet." It is quite convenient in the matter of comparisons, as you cannot leave out one or the other.

Speaking of this matter of "a standard," my experience, limited as it has been, has led me to regard the jet photometer as a very unsatisfactory instrument by which to judge of the candle-power of gas. I have had some experience with it, having had one in my works ever since they were started—some five years ago. I have never regarded it as an accurate standard. I have never used it as a standard; but still I use it every day. But we take readings on our jet photometer every thirty minutes during the whole twenty-four hours. But we use it on our "make" before it goes to the holders; and at night we turn the switch back of the jet photometer, turn it into the district and compare it with the bar photometer, of which a record is made every evening. I find that with a change of coal that jet photometer will vary from 1, 2½ or 3 candles from the bar photometer. I regard a bar photometer with a good burner and Sugg candles as the best, as it seems to me. I never supposed, until I heard my friend Mr. Cabot say so, that there are great difference in candles; because we all have about the same resource in procuring candles. He is fortunate in importing his own, as he supposes. I can see no special merit in that, because the American Meter Company import candles directly from Mr. Sugg. The matter of convenience I did not at all refer to, but to the excellence of the candles. I quite agree with you that there might be a great deal of saving in other branches of the same manufacture if we should import our own goods. We have bought the American Meter Company's candles and Mr. Goodwin's candles. There is a difference in all those candles in the amount of grains of sperm that they will burn. But where the correction in the amount of grains of sperm does not exceed two grains in twenty minutes (we make just two in every twenty minutes) if it does not exceed two in twenty minutes, or six in the hour, you would thereby have over 134 or 146. The correction would be a fair test of the candle power—so far as the candle was concerned. I have always considered that where the candles varies more than that (which they do), the correction does not give the true results. You are still out of the way and in the dark as regards the true candle power of your gas. I am not familiar with any such trouble as Mr. Cabot speaks of with regard to the gas, because we in our vicinity all purchase our candles from Mr. Goodwin or the American Meter Company, and they are imported from London and from Mr. Sugg therefore I cannot appreciate his trouble in that respect. With regard to the burners there is a difference; and some short time since I imported a set of Sugg's London Argand, varying in numbers (and the letter indicate the size of the orifice, and the number of holes in the burner, and they are regulated for different candle powers of gas, the same as the American Meter Company's old burners were), the regular Sugg burner, before he got up his improved burner—the London Argand. I was led to do that from a neighboring company. These baffled all my endeavors to make two readings come together. I could not conceive where the difference was for a long time. I finally was invited to go there and look at their gas and see if I could see where the trouble was, and why the two gases did not agree. I saw at once that there was a differrance in the burners. I borrowed his burner to make experiments with, in connection with my burner, and I saw the difference at once. I immediately went to work and got some of my own of that kind of burner—the London Argand. I got, I think four, and experimented with the old burner and found there was a difference of 10.68 per cent I made quite a number of experiments with regard to the two burners, using the same candles and making the same corrections. I have continued to use that London argand burner since, and when I make any tests of coal I make the correction and deduct 10.68 per cent. from that, knowing that at present most of the companies in our vicinity are using the old burner. I think that the State Inspector of the State of New York, Mr. Love, is using the old burner. I see no good reason why he should not. My argument is that we are entitled to every improvement in the way of burners that is for sale to the general public, and Sugg burners are for sale to the general public, and our consumers have just as good a right to buy those burners as we have. I see no reason why we should limit ourselves and damage our reputation, by using a poor article to test the gas by. You might as well say that we should use a common street burner with iron tip, as to say that we should use a common argand that does not give the full quality of our gas.

Now, with regard to the jet photometer, we test that every evening by having it run three hours upon the light of the district, and wherever that disagrees I always set it so that it will agree. Now, a little may always throw the photometer out. Since I have had that, I have had three new tips to it. You may put a straw down through the top of it, and think you have cleaned it out. So you have, so far as the straw will go. But you cannot clean out a little bit of a scale that will be formed there, and Mr. Goodwin informs me that the difference of a very small fraction of an inch in the size of that jet will alter the whole flame and alter the whole rate of a jet photometer. He is so particular about it that he allows no one to manufacture those tubes except himself personally; and he goes to such extremes as to bore that hole in the tip, then he takes it in a silver or platinum crucible, and after the moisture is extracted he says that there will still be a little difference in the diameter of the hole, and he has to go over it again to satisfy himself that he has got it exactly right. Here, about a week ago, my jet photometer commenced to show different results from the bar photometer, and having made no change in the coals I felt convinced that it was all due to some change in the jet photometer. I sent on and got a new tip of Mr. Goodwin, and when I put it on the jet photometer came immediately up to the standard of the bar photometer. With this experience before me how can I say that the jet photometer is the true photometer to go by. I don't give it any credit what-

ever. It is a good test on its work, and it will run about a day. I don't give it any further time to run. I don't say that I change mine every evening, but if I change my coal or work any special change in my heats that will alter the density or rarity of my gas, I find it necessary to work a corresponding change in the jet photometer, compared with the bar.

About testing the candle power of the gas, I feel that we all ought to go into one standard of testing our gas. Then we shall take the statements, such as were handed in to you to-day, and look at them with more confidence and interest, and they will be of more value to us than you can calculate. I feel about the jet photometer this way—that while a man might be perfectly honest, he might very likely be badly mistaken, from the effect of the instrument by which he tested his gas.

Thanking you for the permission to make these remarks, I will now give some one else a chance.

Dr. Kidder—Some years ago, in my examination of gas, in connection with what is known as the carburetting process with the vapor of naphtha, combining different qualities of naphtha and gas, weighing the naphtha as I had opportunity to do, measuring the gas and observing the illuminating power, I found that when a fish-tail burner, burning five feet an hour, by the addition of the naphtha vapor, showed an improvement of 100 per cent., I could only obtain an acknowledgement of 76 per cent. with the argand burner. I examined it again and found it to be a fact. The question then came up, "Why is it so?" The argand burner is practically two burners—one flame behind the other. In making examininations we only take the light from one side. Now, as the gas is more rich the film of incandescent carbon is more dense in the flame, and tends to shut off the light from the distant side of the flame. If the gas is poor you get a penetration from the distant side of the flame through the proximal side of it. This, which I hold in my hand, representing the argand burner, the light is taken off of course from one side of the burner, that is, you don't attempt to take the light from the other side, Supposing the candle to be in this direction [illustrating], if you take a poor quality of gas (supposing we say 15-candle gas, that was the quality of the gas I examined), the penetration of the light from the distal side of the flame through the proximal side will be such that you get an acknowledgement of an illuminating value which does not exist. The incandescent carbon in the flame, just so far as it is present, acts as a screen or film, and is a positive obstruction to any light behind it. Therefore, if the gas is poor, the argand burner will tell you that it is better than it really is. If it is rich it cannot penetrate from the distal side of the flame through the proximal side, and you cannot determine the difference in the quality of the gas that actually exists. To prove this I put five burners, one behind the other, and as I added one after another I found I added less and less of acknowledged light by the photometer, showing that each one of those flames shut off a portion of the light behind it. It was a very interesting experiment, and one which convinced me that the argand burner was not a suitable burner to determine the difference in illuminating power of different qualities of gas. And I am strongly induced to look upon the fish-tail burner, or bat-wing, if properly made, as a more reliable means than the argand for determining this difference.

The Secretary—Is there not another reason why it is not more reliable? Do not the majority of consumers use the open burner, the fish-tail or bat-wing, or the check-burner (which combines the two) for general use, rather than the argand. When we test by the best argand burner that is made, the Sugg burner, one that tends to show the best light, do we test our gas by the burner that is in general use by the public?

Dr. Kidder—That I think is an important question to consider. It seems to me that it should be tested by such a burner as is in common use, so that you know what you are delivering to your customers. But the argand burner, for the reasons I have stated, is, to my mind, an entirely improper thing to use. I took occasion to bring this matter forward at the office of the Boston Gas Light Company, Mr. M. S. Greenough and Mr. Lamson being present. It was suggested that the manufacturers of England or Scotland had sifted the matter of gas making so closely, that there was very little chance of our doing anything—or something of that purport. I brought this forward for the purpose of showing that they had not sifted it very closely. I told them that the argand burner was not a suitable thing to test gas with, and never was; and gave Mr. Greenough the reason why it was not, and he acknowledged the point.

The Secretary—This illustration in my hand is the shape of the flame of an argand burner, perhaps exaggerated a little, and *there* is the candle. The candle is in that direction from the screen, and we are testing. You see that the flame from *this* side obscures the other flame; and your idea, Dr. Kidder, would be to split it open and make one flame.

Dr. Kidder—Yes sir. Of course the richer the gas is the more completely is the light beyond it obscured. You get but slight acknowledgment of the light behind it. But if your gas is poor in that degree you have a penetration of light from the other side of the flame, and you get an acknowledgment of a difference of light which does not exist.

Mr. Harbison—As gas is ordinarily burned in an argand, is not the objection of Dr. Kidder done away with, where the gas is reflected downwards from the burner, and not sideways? As the argand burner is used there is a flame which reflects down, and one side of the flame does not show through the other. Is not the objection done away with in such a case as that, and is not that the way that consumers use the argand burner? They do not want it for side reflection, but to bring the light down where they are using it.

[To be continued.]

Gas-Light Intelligence.

OUR EXCHANGES.

[*From the Coal Trade Journal.*]

Hartford, Conn., pays $2.75 per thousand for gas; coal used annually is 8,500 tons Westmoreland.

Newark, N. J., pays $3.00 for gas; there are two companies, the Citizens', and the Newark Gas-Light Company.

Net price for gas at Worcester, Mass., is $2.57 per per thousand; 45,000,000 feet are sold annually.

At Derby, Conn., the price is from $2.50 to $3.00 per thousand, according to quantity used. The amount of gas sold in 1877, was 6,057,000 feet, made from 567 tons of Westmoreland coal.

Gas in New Haven is $2.75 per thousand; there is 7,000 tons of Westmoreland and Kanawha used annually.

At Norwich, Conn., $3.50 per thousand is charged for gas, less five per cent. for prompt payment. Some 900 tons of Westmoreland were used, with 400 tons of Newcastle, England, and 200 tons of Lehigh cannel, last year.

At Wilmington, Del., the net price is $2.25 per thousand for gas; 4,800 tons of coal are carbonized annually.

The Pottsville (Pa) Gas Company uses, on an average, 150 tons of Westmoreland coal per month, or say 2,000 per year. The *Miners' Journal* Publishing Company uses five tons per month, or sixty tons per year.

Correspondence

[Correspondents, in all cases, should sign their communications with their names and address in full—not for publication, unless desired, but as a guarantee of good faith.—Ed

[Special Correspondence of the American Gas-Light Journal.]

Gas Notes from Ohio.

Columbus, Ohio, March 20, 1878.

A number of newspapers throughout the West, during the past winter, have been giving a good deal of space, and free advertising, to the "Electric Light." Notably so is the *Cincinnati Commercial*, which seems to be as much of a monomaniac on this subject as it has been about "the dollars of our daddies." It has given numerous elaborate and complex descriptions of the light, and, at intervals, has illumed its page with wood cuts, alphabetically elucidated, of the machine.

In its editorial columns it predicts the total disuse of coal gas as an illuminating power, and the substitution, for private and public purposes, of electricity. The same paper strongly urged the use of the "electric light" in the new "Springer Music Hall," in Cincinnati. The committee in charge of the building of this grand and costly hall, I am informed, at the suggestion of the *Commercial*, gave considerable time and thought to the investigation of the "light," which resulted in a unanimous opinion that they would make no experiments, and that coal gas would satisfy all demands as to the lighting of the building, and would be as economical as any illuminating power they could get. So the music hall of Cincinnati will be lighted by gas, and brilliantly so.

In one or two cities in this and neighboring States, suits that have been pending in the courts for some time, between the municipality and the gas company, have recently been decided. One such that we note is that in Covington, Ky., which city is really a suburb, or part of Cincinnati, being located opposite that city, on the Ohio river. It has a population of about 30,000.

In December, 1872, suit was brought by the city of Covington against the Covington gas-light company to recover an amount alleged to have been overpaid on a contract between the city and the company, the question being the proper interpretation of the language of the contract—"when the average aggregate amount of consumption shall exceed 40,000 cubic feet." The company claiming that the estimate must take into consideration each year's consumption since the organization of the company; while the city claimed that the last year only was to be taken as a basis upon which to estimate.

It was alleged that the contract had been violated by the company, and that it had overcharged the city some $10,000. In the petition of the city a reduction of rates was also asked. The suit was vigorously pushed; but no decision was given until the fourth of this month when, after long and verbose arguments on both sides, the court delivered itself of an opinion noted for its prolixity, and adjudged that the city might recover from the gas company $8,400, and pay the costs of the suit. The decision of the Chancellor in this case only relates to a limited term of years; and, elated with victory, the city is about to bring another suit covering an almost indefinite number of years. The company has appealed the case to the Court of Appeals, and it will probably not be heard until September next.

In the city of Dayton, Ohio, the gas company has for some time been furnishing gas to the city on credit. When the two corporations came to settle they differed widely in their accounts, and it seemed as though the gas company would have to resort to the courts for an adjustment; but, on the first of this month, a satisfactory basis for settlement was made, and the city of Dayton paid its gas company, on the sixth of March, an arrearage of $13,000, which squared accounts.

In several cities in the West the contracts between

the cities and their gas companies will expire this spring. In all such places considerable interest is evidenced in gas affairs by the citizens, and vigorous efforts will be made to renew at a much lower price. This state of affairs exists just now in Peoria, Ills., in which city the gas company's contract will soon expire. A number of meetings have been held by the citizens of the place, and appointed a committee to negotiate with the gas company.

If no reduction is made they *threaten* the company with a new organization. A large portion of the stock of the Peoria company is held by St. Louis parties, and they do not seem to be inclined to yield to the demands made of them.

A gas explosion took place at Harrison, Ohio, on Friday, March eighth, that was terrible in its results. Harrison is a small town, a suburb of Cincinnati, about twenty miles distant from that city, and near the Indiana state line. A very handsome new Town Hall has recently been erected in the village, and in this building was located the Post Office, and all the municipal offices. Being ambitious of appearing as metropolitan as possible, a gasoline machine of the McKenzel make, was purchased for the purpose of illuminating the building, and properly placed in the cellar. When the machine was first put up, some two months ago, considerable time was expended in making it work right, and ever since it has had to have more or less tinkering done to it.

About seven o'clock in the evening of the day of the disaster the machine got out of order, and would yield no flow of gas to the Post Office, and various rooms in the building. Three of the village councilmen, Messrs. Rupp, Probst, and Fisher, descended to the cellar to ascertain the cause of the trouble, and "set" the machine right. As soon as they entered the cellar they detected the smell of gas; but Mr. Probst, whose sense of smell was imperfect, did not notice it as much as the others, and was about to light a match. The other gentlemen warned him not to think of such a thing, but he persisted, and they started for the door, but not in time to escape the fearful explosion that at once took place, as soon as the match was ignited.

The roar was terrific; the whole building seemed to rise in the air, and in a moment fall to pieces. The Post Office was filled with people who had come to get their mail from the evening train, and it is a mystery that any of them escaped alive. A little girl, Katie Roll, aged ten years, was found, after the smoke and dust had cleared away, hanging head downward, her feet having caught in the floor. Her flesh was fearfully crushed, her clothes burned from her body, and her screams of agony fearful. The men standing by were prevented from going to her rescue by the flames which encircled her, and had to see her literally roast to death without being able to aid her. Councilman Rupp was instantly killed, and Councilman Probst was so badly burned that he died the next day. Fisher's clothes were on fire when he escaped and rushed into the street, and he was seriously and painfully burned. Some ten or twelve other persons were burned and injured quite seriously. The damages to the building are estimated at $3,000. There is a difference of opinion as to the cause of the explosion, whether it was an opened stop cock that allowed the gas to escape, or a deficiency in the machine. Good evidence points strongly to the latter. The *Cincinnati Gazette*, commenting editorally on the affair, says:

"Now comes the gasoline machine men, with the statement that it was not their machine that exploded at Harrison. Gasoline is an explosive article, and when the vapor comes in contact with fire it is sure to explode. The people should understand that *all* gas machines are dangerous, and that they are as liable to explode as a powder magazine. If anybody has doubt upon this point, he has only to knock the bung out of a barrel containing gasoline, and go within six feet of it with a lighted candle, to be convinced, or rather to convince other people. The person foolish enough to try the experiment would not live to tell the result. Never mind what the machine men say. Don't go near a gasoline machine with a light in your hand; neither should these machines be located in or near a house. The least bit of carlessness may at any time produce a disastrous explosion."

While speaking of this gasoline machine disaster, it is not inappropriate to state that a meeting of the Board of Directors of the Cincinnati Work House, the superintendent reported that the gas carburetter inserted in October last, by certain parties on trial, upon the pretense that it would diminish the gas bills, had proven very unsatisfactory. He also stated that the pipes and burners were being filled with a greasy substance, and it was his opinion that the "machine" should be taken out, as the gas bills had increased since its use instead of diminished. The Board resolved that it should be removed at the expense of the parties putting it in. During the past Winter the "gas question" has been much discussed by the papers of this State, and especially so by those of Cincinnati. In that city the municipal authorities have been trying to cut down expenses by lighting the public lamps on the "moonlight plan," but it has given great dissatisfaction to the citizens, and even the local press denounce the system. One paper vigorously urges the taxing of abutting property, in order to create a public lamp fund. Some very wicked legislation on gas affairs, it is intimated, will yet take place in our legislature here before the end of the session. If we do not have a "bill to regulate the price of gas," or something of that kind before the legislature adjourns, it will be a phenomenon in the history of the Ohio Legislature.

In the village of Glendale, a suburb of Cincinnati, much complaint is made against the Mutual Gas Company of the town, for charging *five* times as much for gas as is specified in the contract entered into with the Common Council. The company give the novel reply to the complaint that as the gas they furnish is *five times better than the standard required by ordinance, they have a right to charge five times as much for it as the stipulated price, which is* $2.00 *per thousand.* I hear it rumored that a new gas company is soon to be organized in Indianapolis, Indiana, backed by the "Capital Gas Light, Improvement and Construction Company of Washington, D. C.

In Cincinnati the price of gas has not yet been changed, though much correspondence on the subject has passed between General A. Hickenlooper, President of the Cincinnati Gas Light and Coke Co., and the Light Committee of the Board of Aldermen and Council.

In our own city gas matters are quiet, and there is nothing thrilling to report from Ohio's capital.

Ubiquity.

San Jose, California, March 16th, 1878.

Mr. Editor: Will you please inform me why the fifteen hole argand burner is used by the examiner for testing the gas furnished for the street lamps and the public buildings in the City of New York?

Are there not argand burners now in use which will show better results, consuming the same gas, than the fifteen hole burner?

If I can produce a gas which will show an illuminating power of sixteen candles, when consumed in one of the new argands, that is really not above thirteen candles when tried by the fifteen hole argand, have I not the right to do so, and to say that I am making a sixteen candle gas?

The Congress of the United States has just declared that 90 cents worth of a certain mixture coined in their mints is a dollar, and must be received and counted as a dollar; if such a right (?) can be exercised in regard to money, why not in regard to the illuminating power of gas?

Of course this desire of mine may not be strictly honest towards those with whom we deal, as we have an implied contract (not a written one) to furnish gas of sixteen candle power, and if we show that the gas made by us is up to that point, as measured by one of the improved burners, do we not furnish a sixteen candle gas?

If other companies choose to submit to such old fashioned ideas as these fifteen hole argand burners, and allow their gas to be tested by examiners who persist in the use of burners which have become obsolete, simply because they wish to be governed by the standard set up when better burners were unknown, is that any reason why I should submit the gas made by our company to any such old fogy test?

Now there are, of course, some people who would object to every gas engineer setting up a standard of his own for determining the illuminating power of gas, just as their are people who object to having cloth measured or coal weighed by any standard that might be established by the party having these articles for sale; but are not such persons generally found to be of the old-fashioned non-progressive kind, who were educated when things moved much slower than in these days?

Now, Mr. Editor, would it not be well to let every gas engineer have his own standard, and if he produce gas in his works which by his standard proves to be of sixteen candles, although when tried by the fifteen hole argand it is really of only ten candles, why let him do so; but when he compares yield and quality with other engineers, let him state by what means he arrives at the quantity and quality of the gas he produces.

But here on the Pacific coast we don't make as much gas as some of your newly constructed works are reported to make, per lb. of coal carbonized; but when we are getting much over five and a half cubic feet to the lb. from ordinary caking coals, and calling the gas of sixteen candle power, we naturally want the most improved burner to show it by. I hope we may hear from some of the engineers using the improved argand burners.

J. T. B.

Our Gas Bills.

The Story of the Meters—The Startling Surprise of the Last Quarter's Chapter, and how the Gas Company Explains it.

"Neighbor, how's your gas bill, for the last quarter?"

"Tremendous! Biggest I ever had! The lower the price the higher go my bills. How's yours?"

"Ditto. Never saw anything like it. They say the company's put on extra weights to force the gas through the metres, and half we pay for is air. I'm going to try kerosene.

How many times have our readers heard colloquies something like this since the gas bills for the last quarter came in! And then would follow denunciation of the gas company as an extortionate monopoly, bent only on getting as much as possible out of its customers for the least possible service. And more of the same sort.

A reporter of the *Courier*, in search of light on the somewhat dark subject of gas, sought out Mr. A. C. Wood, the always obliging Superintendent of the Gas Light Company. Our reporter, premising that there was a general surprise among our citizens over the magnitude of their gas bills for the last quarter, asked Mr. Wood how he accounted for this unexpectedly large increase in these bills.

"Gas consumers," replied Mr. Wood, "in comparing their gas bills, are apt to compare with the previous quarter instead of the corresponding quarter the year before. The quarter which ends March 1st is always the heaviest quarter of the year, whereas the quarter that ends December 1st (with which they are apt to make their comparisons) is, with one exception, the lightest quarter of the year. Obviously this is not a fair comparison. So far as the unusual amount of consumption for the quarter just ended is concerned, we account for it in this way: We have had a dark open Winter. A new fall of snow makes about half an hour's difference every evening, in the time of lighting up; and a dark rainy night, with no

snow on the ground, requires the gas to be lighted from one hour to an hour and a half earlier than is required on a clear night with snow on the ground. Everyone knows that we have had very little snow, and lots of dark rainy nights since winter began. Whatever extra percentage of gas has been consumed the past quarter, is easily accounted for by this having to light up so much earlier o' evenings.

"As we keep a daily record of the weather, we are enabled to give a comparative statement of it for the three months ending March 1st, 1877 and 1878, as follows:

	1877.	1878.
Number of days in which there was a fall of snow	34	14
Number of days of clear weather	37	32
Number of days of dark, cloudy weather and rain	19	44
	90	90

From which it will be seen that the number of days on which there was a fall of snow during the three months of 1877, exceeded that for the same period of 1878, 20 days or 14 3-10 per cent., and the number of dark rainy days in 1878 was 25, or 56¾ per cent. in excess of that in 1877, all of which help to increase the consumption ot gas."

Our reporter took the occasion of this interview to interrogate Superintendent Wood, who has been for twenty years in the service of the company, as to a few points of interest concerning the company. The following questions were put to Mr. Wood, which he unhesitatingly answered, as appears below:

Ques.—What was the capital stock of your company at its organization in 1849, and what is to-day?

Ans.—The capital stock originally was $100,000, afterwards reduced to $75,000. To-day it is $330,000. In addition the stockholders hold $100,000 in bonds issued to them by the company.

Ques.—How many times has your original stock been watered?

Ans.—Not any at any time. Every increase of capital stock has represented an equal amount of money actually paid out for improvements.

Ques.—What amount of dividend did the company pay out last year, in either money or stock, and what was the rate?

Ans.—In stock, nothing. In money, $33,000, or ten per cent. on the capital stock. In addition the company paid $8,000 interest on the bonds referred to already, which bear 8 per cent. interest. Altogether, therefore, the company divided $41,000.

Ques.—What was the rate of such dividend, reckoned on the actual investment.

Ans.—About seven and a half per cent.—the actual investment being over $550,000.

Ques.—What, represented by candlelights, is the quality of the gas you are now furnishing?

Ans.—Eighteen to twenty candles.

Ques.—Is it the same quality as you have been in the habit of furnishing heretofore?

Ans.—For the past four years or so we have furnished the same as we are now making. Previously to that the gas we made was of a lower quality—from fourteen to sixteen candles. We never made better gas than we are now furnishing to consumers.

Ques.—What quality of coal do you use in its manufacture, and what do you pay for it a ton.

Ans.—We use bituminous and cannel coal, which costs us about $5 per ton.

Ques.—What pressure do you maintain now?

Ans.—The pressure is maintained now at two inches, the same as for twenty years past.

Ques.—What is the percentage of the reduction in the cost of manufacturing 1000 feet of gas to-day below the cost in 1870?

Ans.—Fourteen and two-fifths (14 2-5) per cent.

Ques.—What is the pecentage in the reduction you have made in the price of gas compared with 1870?

Ans.—About twenty-one and one-half (21½) per cent. In 1870 we charged $3.50 per thousand feet. To-day we sell it for $2.75.

Ques.—What was the amount of gas consumed for the quarter ending March 1, 1878, and what was the amount for the quarter ending March 1, 1877?

Ans.—This question we cannot answer until the 15th of this month, when the books are written up.

Here our interview ended. When the 15th inst. shall have arrived we expect, through Superintendent Wood's courtesy, to lay before our readers a comparison of the consumption of gas the last quarter with the quarter a year ago. The law of compensation holds good here, too; for, if our gas bills, owing to the open winter, have been larger than a year ago, have not our coal bills been smaller?—*Syracuse Courier, Mar. 11th*, 1878.

Prices of Gas Coal.

The large contract for Westmoreland and Penn coal last season for this year, delivery in New York, has left but little to be done in the way of new transaction in that market. Within the past fortnight rumors have been current that the combination of 1877, between the Pennsylvania Railroad Company and the Baltimore and Ohio Company, for the regulationof price in New England was likely to be broken, and that the latter market would be thrown open for general competition, without retraction as to port of shipment. Some confirmation has been given to this rumor, by the activity in freight on gas coal from Baltimore and Philadelphia for eastern States, coupled with the report that the price of coal for New England had been fixed at $4.00 f. o. b. at Baltimore or Philadelphia. Coastwise freight are now extremely low, and if prices of coal were placed on a satisfactory basis, there would be a general movement on the part of consumers to order forward their supplies.

We note that the new proprietor of "Moores" Youghiogheny mine have secured some contracts in Albany and vicinity, at about $5.00—2240, delivered at those points. The coal will have to be transported by rail some 300 miles to reach where it will take the canal to the required point.

The Waverly Coal and Coke Co., who were excluded from the New York market last year announce they intention of entering the market this year, and have already secured some orders.

Shipments of caking coal from over the Chesapeake und Ohio Railroad continue to be made—mainly to the eastern markets—with an occasional cargo to New York and Philadelphia. The Kanawha cannel, from over the same road, is coming forward to the extent of 1,200 and 1,500 tons weekly, showing the high esteem in which these cannels are held, as enrichers, by the gas companies.

It is stated, on pretty reliable authority, that the Philadelphia Gas Trust have recently entered into a contract for 400,000 tons of Westmoreland and Penn coal, at $5.30–2,000 lbs., equal to nearly $6 00–2,240 lbs., delivered in their works at Philadelphia. The quantity named would be quite 18 month's supply for the gas company, and the price of it will be noticed to be fifty cents higher than the same coal delivered in New York, and nearly two dollars per ton higher than the New England consumer will likely be called upon to pay f. o. b. at Philadelphia and Baltimore.

Two cargoes of English caking coal sold to arrive at New York, at $4.00 currency, delivered. A steamer with 700 tons of Provircial coal arrived at New York last week.

We note some shipments of American gas coals to the West Indies. These coals cannot fail to be appreciated in that market, although the cost delivered there is somewhat more than the Newcastle hertofore in exclusive use by the Cuban gas companies.

We quote the standard gas coals at New York:

Westmoreland, Penn, Waverly, Youghiogheny	5.50
West Virginia	5.35
Chesapeake & Ohio	5.25
Provincial	4.15 @ 4.50
Newcastle, best quality	4.00
Cannelton cannel	10.00

Reduction in Prices.

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GENERAL AGENT FOR

P. H. & F. M. ROOT'S

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GAS EXHAUSTERS

COOKE & BEGGS,
Selling Agents.

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March 28, 1878.

Am. Gas-Light Journal,
New York.

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Yours respectfully,
Cooke & Beggs,
Selling Agts.
Per S. S. Townsend,
Gen'l Agent.

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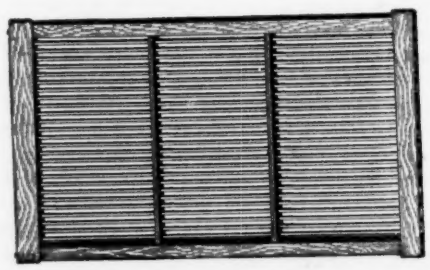

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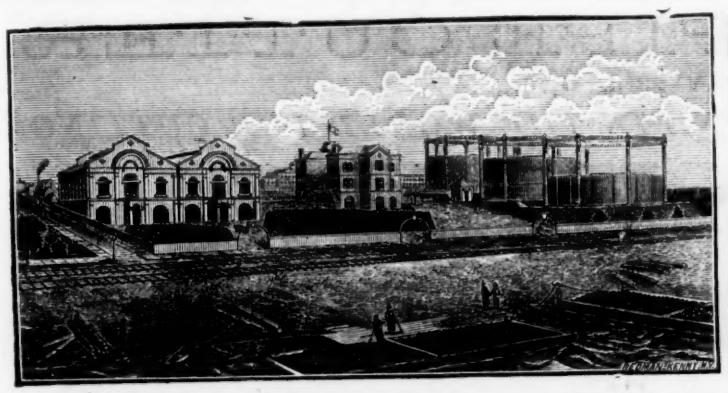

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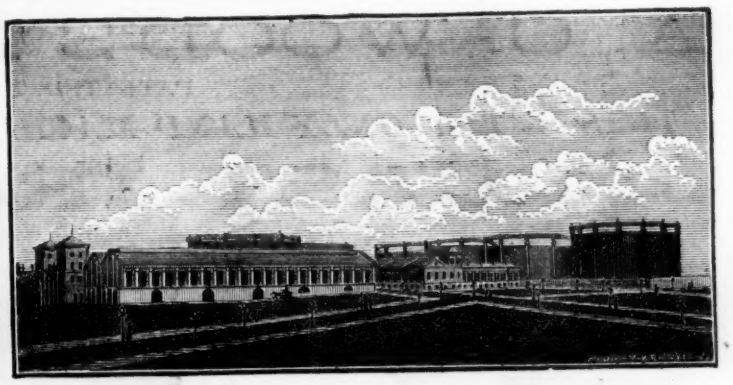

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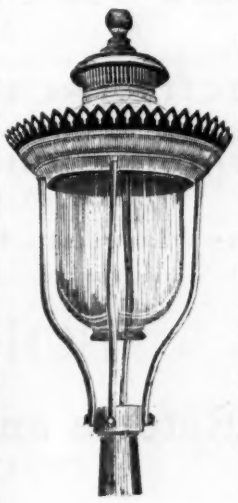

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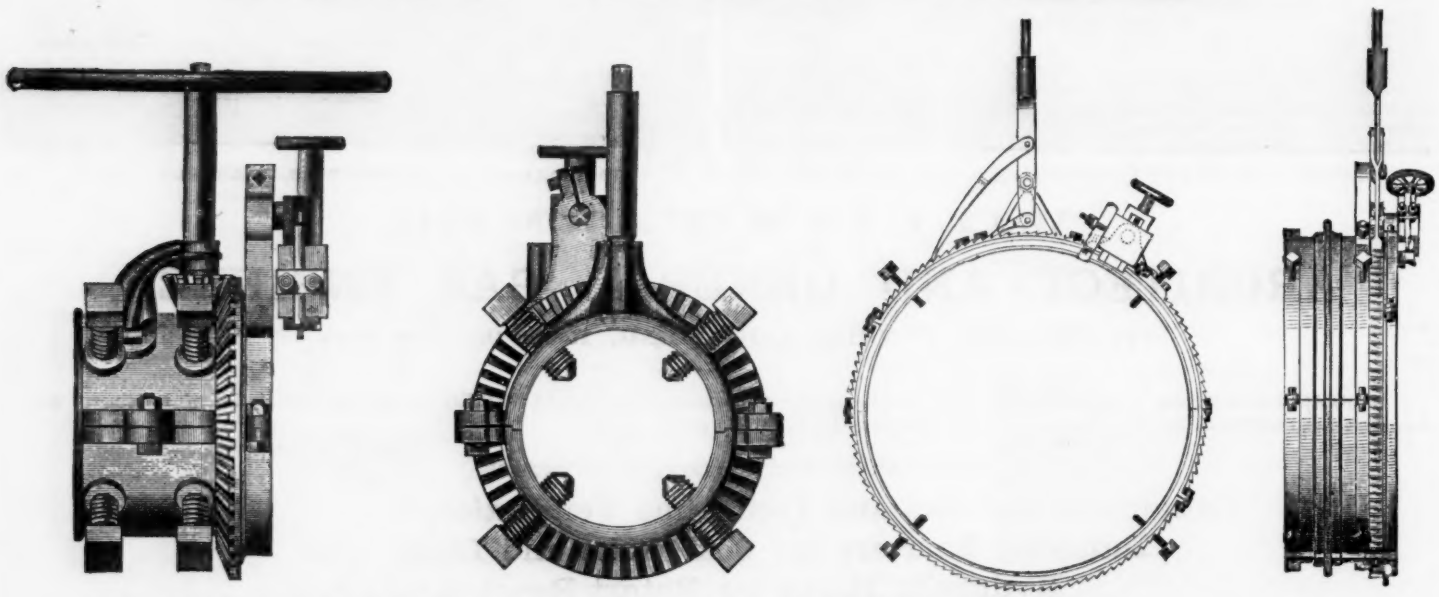

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Yours faithfully,
(Signed) GEORGE M. FURBY, Manager and Secretary.

GAS WORKS, CHARLESTOWN, P. E. I., March 8, 1877.

E. S. CATHELS, ESQ.

Dear Sir: Yours of the 2nd inst. to hand and contents noted. In reply I beg to say that I set a bench of five retorts last summer upon your plan. They have been working up to the present time, and have given such satisfaction that I shall in future set on the same plan.

Yours truly,
(Signed) WILLIAM MURPHY, Manager.

OFFICE OF THE CINCINNATI GAS-LIGHT AND COKE COMPANY,
CINCINNATI, March 8, 1877.

E. S. CATHELS, ESQ.

Dear Sir: Yours of 2nd inst. received, and in reply state that we have one house—34 benches—of your three chambered, seven retort settings, which have given entire satisfaction. Respectfully,
(Signed) A. A. HICKENLOOPER, V. P.

GAS WORKS, MEDINA, N. J., March 10, 1877.

MR. E. S. CATHELS.

Dear Sir: In reply to your enquiry as to the working of your setting, I have pleasure in testifying that I have not seen better or more uniform heats in an experience of twenty-five years, and there is little fuel required.

Yours truly,
(Signed) J. FINDLAY.

LISBURN GAS-LIGHT COMPANY, LIMITED,
LISBURN (IRELAND), March 20, 1877.

E. S. CATHELS, ESQ., Montreal.

Dear Sir: In reply to yours I have now four beds of six retorts set on your plan, which have given me great satisfaction, with no difficulty in obtaining good heats. My make for the last nine months has been 9,760 feet per ton of coal, and there is more coke for sale than formerly. Yours respectfully,
(Signed) EDWRED STEARS, Manager.

GAS WORKS, APELDOORN (HOLLAND), March 28, 1877.

MR. E. S. CATHELS, MONTREAL.

Dear Sir: I am in possession of your letter of the 2nd inst., and in reply I can certify that I have been working during seven months with the oven with two retorts constructed upon your principle, and am highly satisfied with the results. The fuel account has been much less than before, and the retorts are equally and sufficiently heated.

As I don't have a station meter I cannot give the exact results of the production of gas per ton of coal, but there is no question but that the results have been far better than with any other oven employed by me.

Yours truly,
(Signed) R. BAKKER.

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[From the AMERICAN GAS-LIGHT JOURNAL, Oct. 2, 1877.]

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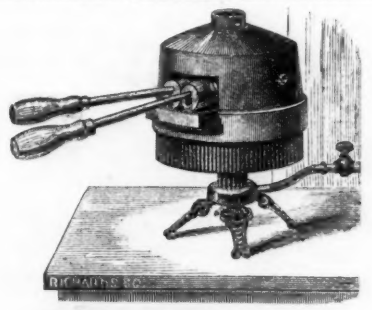

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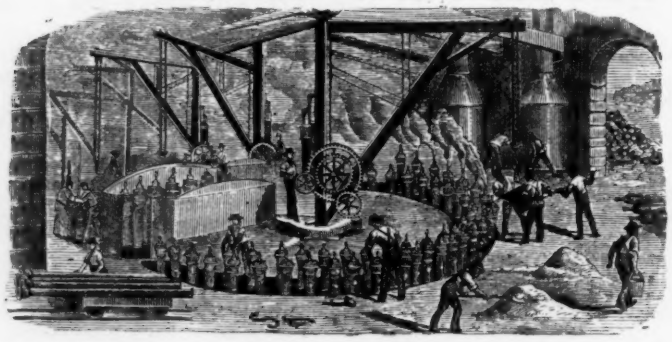

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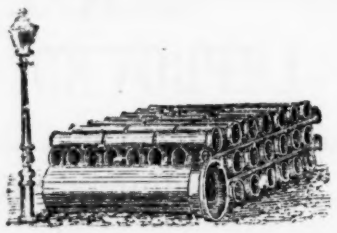

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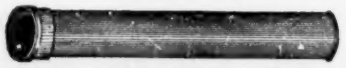

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MINERS AND SHIPPERS OF
YOUGHIOGHENY GAS COAL.

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W. P. DE ARMIT, Treasurer.
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351-1y

THE NEWBURGH
Orrel Coal Company,

Mines at Newburg, Preston County, W. Va.
Company's Office, No. 52 S. Gay Street, Baltimore, Md.
C. OLIVER O'DONNELL, Pres't. CHAS. MACKALL, Sec'y.
CHAS. W. HAYS, Agent in New York, Room 7, Trinity Building, 111 Broadway.

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It has been for many years very extensively used by various Gas Companies in the United States, and we beg to refer to the Manhattan, Metropolitan, and New York Gas Light Companies of New York; the Brooklyn and Citizen's Gas Light Companies of Brooklyn, N. Y.; the Baltimore Gas Light Company of Baltimore, Md., and the Providence Gas Light Company, Providence, R. I.

Best dry coals shipped from Locust Point, wharves, and prompt attention given to orders for chartering of vessels.
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Among the consumers of Despard Coal, we name: Manhattan Gas Light Company, New York; Metropolitan Gas Light Company, New York; Jersey City Gas Light Company, N. J.; Washington Gas Light Company; Portland Gas Light Company, Maine

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CHARLES W. HAYS, Agent, Room 7, 111 B'way, N. Y.
SHIPPING POINT—Baltimore, Md.

This coal yields 10,000 cubic feet of Gas with an illuminating power of over 16 candles. Forty bushels of very superior Coke, with little Ash and scarcely any clinker 94-1y

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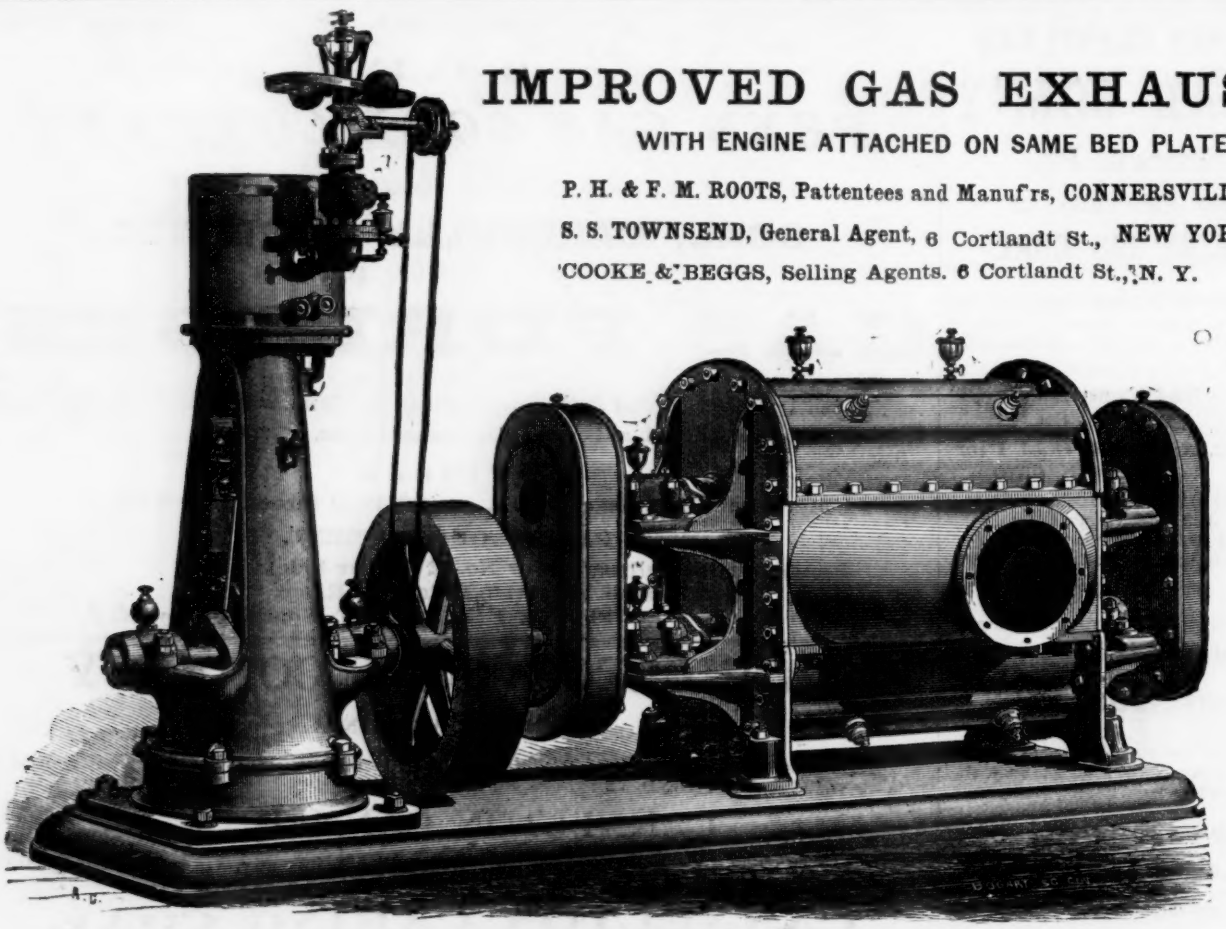

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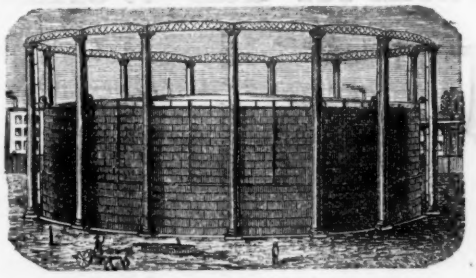

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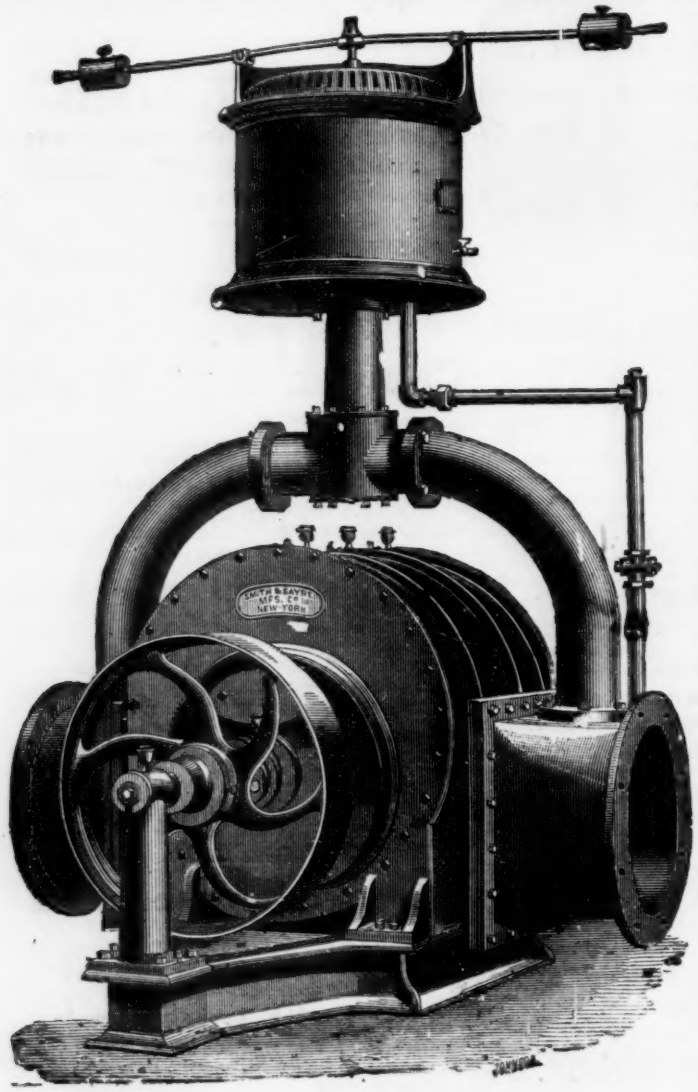

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